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Price List

— of —

Agricultural Seeds,

And Treatise on

Permanent Pasture

Grasses

— and —

The Adulteration of their Seeds.

James Hunter, Limited,

Agricultural Seed Merchants,

Chester.

THE SEED CROPS OF 1909.

Owing to the prevalence of cold, wet and sunless weather during the time of ripening and harvesting of the seed crops of Grasses, Clovers and Roots, in 1909, the yield was generally deficient both in quantity and quality, and in some cases a total failure was experienced. On the other hand, some species were more favoured, and produced good crops, so that these are cheaper than usual. The increased prices of some sorts are thus counterbalanced by the reduced prices of others, and it is a matter for congratulation that, after such an unfavourable season, the cost of seeds per acre for laying down land to Grass remains about the same as last year.

Even more than the usual care has been necessary in the selection of our stocks of seeds to secure those of the highest germinating power, and no pains or expense have been spared to attain this end. The very high percentages of germination we are able to guarantee in this Price List will show how we have succeeded.

We look forward hopefully to more favourable grass seed harvests than we have had of late, and to a considerable reduction in the price of these seeds, so that the laying down of land to grass may not be hindered by the cost of the seeds. In the meantime, however, economy in laying down land can only be attained by the use of the best, purest, and highest germinating seeds (these are always the cheapest), and in a season such as the present it is more needful than usual to secure seeds that reach this high standard.

JAMES HUNTER,
Managing Director.

Telegraphic Address:
HUNTERS, SEEDSMEN, CHESTER.

C. P. HUNTER,
Deputy Managing Director.

JAMES HUNTER, Limited, Agricultural Seed Merchants and Grass Seed Specialists, CHESTER.

THE GUARANTEE SYSTEM.—In January, 1883, the **System** of Guaranteeing the **Purity, Genuineness, and Percentage of Germination** of all Farm Seeds was inaugurated by JAMES HUNTER. Prior to that date, no firm of Seed Merchants in the United Kingdom—or, to be quite correct, in the world—offered to supply Grass, Clover, Root, and all other seeds for the farm under such a guarantee, nor was any Price List giving such a Guarantee ever published previous to 1883. On the contrary, **Non-Warranty Clauses**, disclaiming all responsibility in regard to the seeds offered for sale, were often, and indeed are in some instances still, to be found in such Price Lists.

Great improvement in the Quality, Purity, and Germination of Farm Seeds—and particularly of Grass and Clover Seeds—was an immediate and direct result of the introduction of the **Guarantee System**, and during the past 27 years the advantages resulting from the System to the users of Farm Seeds have been considerable and far-reaching. Much still remains to be done, and until the Sale of all Farm Seeds by Guarantee shall be made compulsory, the users of such seeds will not be fully protected; but in the meantime, those sufficiently alive to the necessity may take the precaution to protect themselves, quite readily, by adopting the recommendation of the Departmental Committee appointed in 1900 by the late Right Honourable R. W. Hanbury, then Minister of Agriculture, for the purpose of enquiring into the Conditions of Sale of Farm Seeds in the United Kingdom, viz.:

“They (the Committee) think that every encouragement should be given to Seed Merchants to give a Guarantee with the seeds they sell, and that farmers should be advised “to buy only subject to such Guarantee, and to test the seeds they have purchased.”

Purity, Genuineness and Germination of all Seeds Guaranteed.

All the seeds offered in this Catalogue are *warranted* pure and genuine, and the percentage of germination of each kind of seed is stated and *guaranteed*.

All seeds are offered and sold subject to the analysis of the Consulting Botanists to the Royal Agricultural Society of England, and the Highland and Agricultural Society of Scotland ; also of DR. STEBLER, Director of the Swiss Seed Control Station, Zurich.

The germination of every parcel of seed offered in this Catalogue has been repeatedly tested by the most perfect methods, and duplicate tests of all important lots of Grasses and Clovers have also been made for us by MR. FINLAYSON, F.L.S., and by DR. STEBLER, of Zurich, whose official reports may be inspected by any one interested.

To enable purchasers to have their seeds analysed and tested before the time of sowing, any seeds required will be delivered carriage free to the purchaser, so that samples for analysis *may be taken from the bulks while they are in the possession of the buyer*. This method is more satisfactory than that of testing a sample received from the seed-merchant before purchasing, as it excludes all doubt about the identity of the seed analysed. In the event of any kind of seed not fulfilling, in every particular, the guarantee of purity, genuineness, or percentage of germination stated in this Catalogue, such seed may be refused, and returned at the expense of the seller, who will also in such a case pay the Consulting Botanist's fee.

It will be understood that while all the Seeds offered in this catalogue are *absolutely guaranteed* to be genuine, of the purest quality, and to possess the highest standard of germinating power, yet no guarantee is given beyond this, as the most perfect seeds may fail when the conditions of season, climate, or culture are unfavourable, and these matters are not under the control of the seller.

In his Price List published in February, 1901, James Hunter referred to the fact that 18 years previously he originated and introduced into this country the system of selling Agricultural Seeds under an absolute guarantee of Purity, Genuineness, and Percentage of Germination, which had brought about an immense improvement in the quality of the Agricultural Seeds sold throughout the Kingdom ; and that the Minister of Agriculture had appointed a Departmental Committee to enquire into the conditions under which Agricultural Seeds are sold. The Report of the Committee was duly presented to Parliament, and the following is the Summary of their Report :—

“ In conclusion your Committee would remark that in their opinion no widespread complaint of the quality of seeds sold throughout the country has been brought under their notice ; on the contrary it was universally admitted that a marked and continuous improvement in the trade as carried on by the larger merchants has been witnessed in the last twenty years.

They think that every encouragement should be given to seed merchants to give a guarantee with the seeds they sell, and that farmers should be advised to buy only subject to such guarantee, and to test the seeds they have purchased. In order to reduce to a minimum all difficulties in the way of such practice, they recommend the establishment of one central seed-testing station, under Government auspices, whose practice and procedure should be laid down and from time to time revised by a small committee of experts. The charges at this station should be moderate and so fixed that seed merchants should be encouraged to sell subject to free re-testing of their seeds by the purchaser, should he desire it.

The small farmer both in the United Kingdom and Ireland (*sic*) can if he chooses follow the example of the more intelligent and enlightened of his class, for even the small dealers would soon take to the retailing of only those seeds which were guaranteed by the wholesale merchants if there were no sale for any other.”

The recommendation of the Committee for “ The establishment of a Central Seed-testing Station under Government auspices ” has not yet been carried out, and the Seed Merchants of Great Britain who wish to obtain Official Reports of the Purity and Germination of their seeds from “ a Seed-testing Station under Government auspices ” must continue to take advantage of the facilities offered them by the Swiss Seed Control Station at Zurich, under the direction of Dr. Stebler. It is, however, satisfactory to note that the Department of Agriculture for Ireland has organized a Seed-testing Station for that country, and Irish farmers can have their seeds tested at a merely nominal fee.

PERMANENT GRASS SEEDS,

Of Guaranteed Purity, Genuineness, and Percentage of Germination, for laying down all kinds of Land to Grass for Permanent or Temporary Pasture.

"The grasses, valuable beyond all others for permanent pasture, are Cocksfoot (*Dactylis glomerata*), Meadow Fescue (*Festuca pratensis*), and its ally Tall Fescue (*Festuca elatior*), Catstail or Timothy (*Phleum pratense*), and Meadow Foxtail (*Alopecurus pratensis*). "These five grasses should form the bulk of all pastures on good soil, either for sheep or "cattle."—MR. DE LAUNE.

The Purity, Genuineness, and Percentage of Germination of all the Grass Seeds offered in this catalogue, are guaranteed, and the percentages of germination reach the highest standard. Notwithstanding their guaranteed high quality they are offered at moderate prices, in some cases, lower than those charged by reputable houses for non-guaranteed seeds.

The advantage of buying Grass Seeds under guarantees of Purity and Genuineness, and with a specific guaranteed Percentage of Germination, seems so obvious, that all buyers of these seeds might, in their own interests, be expected to purchase on no other terms; but there are still many who do not realize the full importance of the matter, and who are content to accept and use seeds, the value and germinating capacity of which they know nothing. With the facilities that exist for buying Grass Seeds possessing a specific guarantee of Purity, Genuineness, and Percentage of Germination (the system inaugurated by Mr. James Hunter twenty-seven years ago, and which has since that time so largely influenced the buying and selling of seeds throughout the world), there is no reasonable excuse for sowing inferior seeds. Seeds of the highest standard of quality are undoubtedly the cheapest, and the strictest economy can only be attained by using the best. It may be taken for granted that seeds sold without a guarantee do *not* reach a high standard, and are inferior in quality to those with which a guarantee is given; in any case, the real value of non-guaranteed seeds is always doubtful and cannot be known to the buyer, so that if economy in purchasing the seeds and successful pastures are desired, guaranteed seeds must be used. All vague statements as to the seeds being of "proved germination," etc., are valueless, as seeds may be either of "proved" good or "proved" bad germination, though the impression conveyed is that they come under the first category. What is of importance to know is the exact germinative percentage of the seed, and unless that is stated, the buyer must remain in ignorance of its value.

On page 41 *et seq.* will be found much useful information on the subject of the Permanent Grasses, and those who are about to lay down land to grass will find it to their advantage to consult these pages. The photo-micrographs (*see* page 33) of the various grass seeds, and the weed seeds and impurities usually found in inferior or imperfectly cleaned samples, will enable the buyer to judge the quality of various samples, and afford the means of gaining a higher knowledge of a subject that largely affects his profit.

The use of "Mixtures" of grass seeds has been frequently condemned by the Consulting Botanist to the Royal Agricultural Society of England in his Annual Reports, and buyers are strongly urged to procure each kind of seed separately, as only in this way can the purity and genuineness of each species be readily observed.

Our Grass seeds, described as "**Finest Quality**," are the most perfect samples that can be produced, and for purity, genuineness, and high germinating capacity they are unequalled. Our reputation as the producers of the highest grade of the World's harvest of Grass seeds is well known and generally acknowledged.

The seeds we offer under the description of "**Fine Quality**" are very good and pure, and of high germinating power, and they are of better and purer quality than much seed that is sold as "**Finest Quality**."

The percentages of germination which we guarantee are those of the seeds as we deliver them to our customers. It is, however, common practice to state the germination of Grass seeds on the result of a sample from which the non-germinating seeds have been removed for the purpose of testing the sample. In such a case the percentage of germination thus stated may be ten to twenty per cent. higher than the capacity of the seed ultimately delivered, and the buyer may thus unknowingly pay a much higher price for his seeds than he believes he is doing.

COCKSFOOT (*Dactylis glomerata*).

The most generally useful grass, either for permanent pasture or alternate husbandry. Grows in almost every kind of soil and situation. *Fully described at page 50.*

FINE QUALITY, 21 lbs. per bushel, with guaranteed germination of 85 per cent.

Per lb., for quantities of 5 cwt. and upwards	0s. 11d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	0s. 11½d.
Per lb., for quantities of less than 2 cwt.	1s. 0d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted pure and genuine, weighing 22 lbs. per bushel, and with a guaranteed germination of 90 per cent.

Per lb., for quantities of 5 cwt. and upwards	1s. 1d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	1s. 1½d.
Per lb., for quantities of less than 2 cwt.	1s. 2d.

MEADOW FESCUE (*Festuca pratensis*).

One of the best species either for permanent pasture or alternate husbandry. Thrives in moist or moderately dry soils. *Fully described at page 54.*

FINE QUALITY, 29 lbs. per bushel, with guaranteed germination of 96 per cent.

Per lb., for quantities of 5 cwt. and upwards	1s. 3d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	1s. 3½d.
Per lb., for quantities of less than 2 cwt.	1s. 4d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted pure and genuine, and absolutely free from Ryegrass; weighing 30 lbs. per bushel; with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	1s. 5d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	1s. 5½d.
Per lb., for quantities of less than 2 cwt.	1s. 6d.

TALL FESCUE (*Festuca elatior*).

For permanent pasture or for a three or four years' lay. Thrives in light dry soils as well as those that are heavy and wet. *Fully described at page 52.*

It is necessary to caution buyers against the use of the Tall Reed Fescue seed of New Zealand growth, much of which is sold as *Festuca elatior*. The New Zealand species is quite unsuitable for agricultural purposes on account of its coarse reedy nature.

FINE QUALITY, warranted genuine Rhenish-grown seed; 24 lbs. per bushel; with guaranteed germination of 90 per cent.

Per lb., for quantities of 5 cwt. and upwards 1s. 3d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 1s. 3½d.

Per lb., for quantities of less than 2 cwt. 1s. 4d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted genuine Rhenish-grown seed; weighing 26 lbs. per bushel, and with a guaranteed germination of 94 per cent.

Per lb., for quantities of 5 cwt. and upwards 1s. 5d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 1s. 5½d.

Per lb., for quantities of less than 2 cwt. 1s. 6d.

MEADOW FOXTAIL (*Alopecurus pratensis*).

Indispensable for permanent pasture on all good soils. It thrives best on rich, moist soils, and does well under irrigation, but does not succeed in dry soils. *Fully described at page 47.*

FINE QUALITY, 12 lbs. per bushel, with guaranteed germination of 80 per cent.

Per lb., for quantities of 5 cwt. and upwards 1s. 1d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 1s. 1½d.

Per lb., for quantities of less than 2 cwt. 1s. 2d.

FINEST QUALITY, thoroughly cleaned, heavy seed; warranted genuine and quite free from *Holcus*, *Alopecurus agrestis*, and Rye-grass; weighing 14 lbs. per bushel; guaranteed germination, 85 per cent.

Per lb., for quantities of 5 cwt. and upwards 1s. 3d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 1s. 3½d.

Per lb., for quantities of less than 2 cwt. 1s. 4d.

CATSTAIL, or TIMOTHY (*Phleum pratense*).

A valuable grass for permanent pasture and alternate husbandry, attaining greatest perfection on deep, moist, retentive or peaty soils. *Fully described at page 57.*

FINE QUALITY, 50 lbs. per bushel, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards 4d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 4½d.

Per lb., for quantities of less than 2 cwt. 4½d.

FINEST QUALITY, thoroughly cleaned heavy seed; warranted pure and genuine; weighing 50 lbs. per bushel, and with a guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards 5d.

Per lb., for quantities of less than 5 cwt., but not less than 2 cwt. 5½d.

Per lb., for quantities of less than 2 cwt. 5½d.

TALL OAT GRASS

(*Avena elatior*).

One of the hardest, most productive, and drought-resisting grasses ; suitable for temporary or permanent pastures. *Fully described at page 49.*

FINE QUALITY, 14 lbs. per bushel, with guaranteed germination of 85 per cent.

Per lb., for quantities of 5 cwt. and upwards	11d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	11½d.
Per lb., for quantities of less than 2 cwt.	1s.

FINEST QUALITY, thoroughly cleaned, extra heavy seed ; warranted pure and genuine ; weighing 16 lbs. per bushel ; with guaranteed germination of 90 per cent.

Per lb., for quantities of 5 cwt. and upwards	1s. 1d.
Per lb., for quantities of 5 cwt., but not less than 2 cwt.	1s. 1½d.
Per lb., for quantities of less than 2 cwt.	1s. 2d.

GOLDEN OAT GRASS

(*Avena flavescens*).

One of the smaller pasture grasses. Grows well in most situations, and is particularly suitable for dry calcareous soils and exposed upland pastures. *Fully described at page 49.*

FINE QUALITY, 12 lbs. per bushel ; guaranteed germination, 70 per cent.

Per lb., 2s. 9d.

FINEST QUALITY, warranted pure and genuine ; weighing 14 lbs. per bushel, and with a guaranteed germination of 80 per cent. Per lb., 3s. 3d.

CRESTED DOGSTAIL GRASS

(*Cynosurus cristatus*).

A small-growing permanent grass, suitable for upland sheep pastures, and for lawns. *Fully described at page 50.*

FINE QUALITY, 36 lbs. per bushel, with guaranteed germination of 90 per cent.

Per lb., 1s. 6d.

FINEST QUALITY, thoroughly cleaned heavy seed ; warranted pure and genuine ; weighing 38 lbs. per bushel ; guaranteed germination 94 per cent. Per lb., 1s. 8d.

HARD FESCUE GRASS

(*Festuca duriuscula*).

A small-growing, drought-resisting grass which succeeds in nearly all soils, and is particularly suitable for dry or upland pastures. *Fully described at page 53.*

FINE QUALITY, 28 lbs. per bushel ; guaranteed germination, 90 per cent. Per lb., 11d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed ; warranted pure and genuine ; weighing 30 lbs. per bushel ; and with a guaranteed germination of 94 per cent. Per lb., 1s.

FINE-LEAVED SHEEP'S FESCUE

(*Festuca ovina tenuifolia.*)

A fine-leaved small-growing grass suitable for lawns and ornamental grounds. *Fully described at page 53.*

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted pure and genuine; weighing 30 lbs. per bushel, and with a guaranteed germination of 90 per cent. Per lb. **2s. 3d.**

ROUGH-STALKED MEADOW GRASS

(*Poa trivialis.*)

For permanent pasture. The most valuable of the *Poas*. An excellent bottom grass. Grows in perfection on moist rich soils in sheltered situations. *Fully described at page 59.*

FINE QUALITY, 28 lbs. per bushel, with guaranteed germination of 90 per cent. Per lb. **1s. 2d.**

FINEST QUALITY, thoroughly cleaned, heavy seed; warranted pure and genuine; weighing 30 lbs. per bushel, with guaranteed germination of 96 per cent. Per lb. **1s. 4d.**

SMOOTH-STALKED MEADOW GRASS

(*Poa pratensis.*)

For permanent pasture. Thrives in dry soils and is capable of resisting great drought, but an inferior grass on good soils. *Fully described at page 58.*

FINE QUALITY, 26 lbs. per bushel, with guaranteed germination of 80 per cent. Per lb. **1s. 0d.**

FINEST QUALITY, thoroughly cleaned, heavy seed, warranted pure and genuine; weighing 28 lbs. per bushel; guaranteed germination 85 per cent. Per lb. **1s. 2d.**

WOOD MEADOW GRASS

(*Poa nemoralis.*)

A fine-leaved grass of pleasing colour suitable for lawns and ornamental grounds, specially adapted for growing in shady places and under trees. *Fully described at page 58.*

FINEST QUALITY, thoroughly cleaned, heavy seed; warranted pure and genuine; weighing 26 lbs. per bushel; guaranteed germination 85 per cent. Per lb. **2s. 9d.**

SWEET VERNAL GRASS

(*Anthoxanthum odoratum.*)

A small-growing early grass, found in nearly all kinds of soils. *Fully described at p. 48.*

FINEST QUALITY, thoroughly cleaned, heavy seed, warranted pure and genuine, weighing 16 lbs. per bushel; guaranteed germination 80 per cent. Per lb. **3s. 0d.**

RYE-GRASS SEEDS,

Of Guaranteed Purity, Genuineness, and Percentage of Germination.

Rye-grass seed is generally sold by the bushel or quarter, frequently without the weight per bushel being stated, but as the weight of a bushel of rye-grass may be any weight between 14lbs. and 28lbs., it is obvious that the value of the seed cannot be known unless the weight per bushel is stated. It is in the interest of the buyer to purchase rye-grass seed by weight and not by measure.

ITALIAN RYE-GRASS (*Lolium italicum*.)

In respect of nutritive value, earliness, productiveness, and quickness of growth after it has been mown, the Italian Rye-grass far surpasses the Perennial Rye-grass. It is indispensable for alternate husbandry, and a limited quantity (not more than 3lbs. per acre) is also useful in permanent pasture mixtures. On moist rich soils and under irrigation the rapidity of growth and productiveness of Italian Rye-grass are really wonderful. *Fully described at page 55.*

FINE QUALITY, thoroughly cleaned seed, 22 lbs. per bushel; guaranteed germination 85 per cent.

Per cwt., for quantities of 10 cwt. and upwards	35s. 0d.
Per cwt., for quantities of less than 10 cwt., but not less than 2 cwt. ...	36s. 0d.
Per lb., for quantities of less than 2 cwt.	0s. 4d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted pure and genuine; weighing 23 lbs. per bushel; and with a guaranteed germination of 90 per cent.

Per cwt., for quantities of 10 cwt. and upwards	38s. 0d.
Per cwt., for quantities of less than 10 cwt., but not less than 2 cwt. ...	40s. 0d.
Per lb., for quantities of less than 2 cwt.	0s. 4½d.

PERENNIAL RYE-GRASS (*Lolium perenne*.)

Known as English Rye-grass, Pacey's, Devonshire Evergreen, etc. The Perennial Rye-grass grows nearly everywhere, and on all soils. It possesses the merit of a free vegetation on any soil, and an early spring growth, but on many soils it is short-lived, and it deteriorates with age. Formerly no grass was so much sown, both for alternate husbandry and permanent pasture, but now that the superior merits of Italian Rye-grass, Cocksfoot, Meadow Fescue, and Timothy Grass are better known and appreciated, Perennial Rye-grass is not so highly esteemed, and in many cases it has been displaced by the other species named. *Fully described at page 56.*

FINE QUALITY, thoroughly cleaned seed, 28 lbs. per bushel; guaranteed germination, 92 per cent.

Per cwt., for quantities of 10 cwt. and upwards	29s. 0d.
Per cwt., for quantities of less than 10 cwt., but not less than 2 cwt. ...	30s. 0d.
Per lb., for quantities of less than 2 cwt.	0s. 3½d.

FINEST QUALITY, thoroughly cleaned, extra heavy seed; warranted pure and genuine; weighing 28 lbs. per bushel; and with a guaranteed germination of 97 per cent.

Per cwt., for quantities of 10 cwt. and upwards	31s. 0d.
Per cwt., for quantities of less than 10 cwt., but not less than 2 cwt. ...	32s. 6d.
Per lb., for quantities of less than 2 cwt.	0s. 3½d.

CLOVER SEEDS,

Of Guaranteed Purity, Genuineness, and Percentage of Germination.

The Clover seeds we offer are guaranteed to be of the very highest quality. They have been selected with much care, and have been perfected by our various processes, by which all immature and imperfect seeds, together with the seeds of weeds or other impurities, are removed. The percentage of germination we guarantee for each kind is exceptionally high, and the guaranteed purity and high germination of these seeds combine to render them the cheapest in the market.

Clover seeds of well-ripened quality have a certain proportion (varying from 5 to 30 per cent.) of what are technically called "hard seeds." These hard seeds have an outer shell which is impervious to moisture, and after sowing they remain in the ground unaffected by the influences which cause seeds to germinate, and are thus lost to the sower. Botanical experts, when testing the germination of Clover seeds, only accept one-half or one-third of these hard seeds as of germinating quality, and on this basis those samples which contain a large percentage of hard seeds have a depreciated value. To remedy this defect, James Hunter discovered a process by which the hard seeds are rendered quick-germinating, and for many years past all our Clover seeds have been treated by this method, with the result that we are able to guarantee an average germination of 98 per cent. for all our Clovers, a standard of germination never yet attained by any other house. It is obvious that seed of such perfect germination is cheaper than ordinary seed, as a less quantity may be used; and it has the great advantage of germinating immediately after being sown.

Clovers, and the impurities found in their seeds, are fully described on pages 60 to 63. For illustrations of the seeds see page 33.

Red, or Broad-leaved Clover (*Trifolium pratense*).—The most generally useful of all Clovers for alternate husbandry on good soils.

FINE QUALITY, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	10d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	10½d.
Per lb., for quantities of less than 2 cwt.	10¾d.

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb., for 5 cwt. and upwards	11d.
Per lb., for less than 5 cwt., but not less than 2 cwt.	11½d.
Per lb., for less than 2 cwt.	1s.

Perennial Red Clover (*Trifolium pratense perenne*).—Commonly called "COWGRASS." Recommended for permanent and temporary pastures, particularly those on medium and heavy soils.

FINE QUALITY, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	11d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	11½d.
Per lb., for quantities of less than 2 cwt.	1s.

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb., for 5 cwt. and upwards	1s. 1d.
Per lb., for less than 5 cwt., but not less than 2 cwt.	1s. 1½d.
Per lb., for less than 2 cwt.	1s. 2d.

Late-flowering Red Clover (*Trifolium pratense perenne* var.).—

Commonly called "SINGLE-CUT COWGRASS." Yields a heavy crop three weeks after common Red Clover has been cut, and is thus valuable as a successional crop. It is the most permanent and dependable variety of Red Clover in commerce, and is of great value for rotation layers of two or three years' duration, or for permanent pasture. This is the variety of Clover which has been exclusively used at Clifton-on-Bowmont experimental farm for many years past, and which has proved so very successful there. *See also page 60.*

FINE QUALITY, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	1s. 1d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	1s. 1½d.
Per lb., for quantities of less than 2 cwt.	1s. 2d.

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb., for 5 cwt. and upwards	1s. 3d.
Per lb., for less than 5 cwt., but not less than 2 cwt.	1s. 3½d.
Per lb., for less than 2 cwt.	1s. 4d.

White, or Dutch Clover (*Trifolium repens*).—Grows on almost every kind of soil, and being a deep-rooting plant, withstands the effect of drought on dry sandy soils. It should form a part of all mixtures for permanent pasture, and also for alternate husbandry for more than one year's duration. *See also page 61.*

FINE QUALITY, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	11d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	11½d.
Per lb., for quantities of less than 2 cwt.	1s.

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb., for 5 cwt. and upwards	1s. 1d.
Per lb., for less than 5 cwt., but not less than 2 cwt.	1s. 1½d.
Per lb., for less than 2 cwt.	1s. 2d.

Wild White Clover (*Trifolium repens* var.).—This is the genuine wild species which has given such excellent results in the Armstrong College Experiments at Cockle Park. It is of very permanent character, and well suited for permanent pasture.

FINEST QUALITY, warranted genuine; germination, 96 per cent. *Very scarce.* Per lb., 2s.

Alsike, or Swedish Clover (*Trifolium hybridum*).—This grows as tall as Red Clover, and produces abundant crops. In nutritive value it is almost equal to Red Clover. It should be included in all mixtures for permanent pasture or alternate husbandry. *See also page 62.*

FINE QUALITY, with guaranteed germination of 98 per cent.

Per lb., for quantities of 5 cwt. and upwards	9d.
Per lb., for quantities of less than 5 cwt., but not less than 2 cwt.	9½d.
Per lb., for quantities of less than 2 cwt.	10d.

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb., for 5 cwt. and upwards	11d.
Per lb., for less than 5 cwt., but not less than 2 cwt.	11½d.
Per lb., for less than 2 cwt.	1s.

Trefoil, or Yellow Clover (*Medicago lupulina*).—Being an annual, Trefoil is unsuitable for permanent pastures, but is useful in alternate husbandry, especially on light soils. *See also page 63.*

FINEST QUALITY, warranted pure and genuine; guaranteed germination, 98 per cent.

Per lb.	10d.
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The 1909 seed crop of Trefoil was almost a complete failure, and good seed is very scarce and dear. At its present price it can only pay to sow it in very exceptional cases. We recommend the use of Red Clover instead for this year's sowing.

KIDNEY VETCH (*Anthyllis vulneraria*). Strongly recommended for sowing on light, dry, sandy, chalky or limestone soils, and on soils where red clover does not thrive. 2 lbs. to 3 lbs. per acre is the quantity generally used in mixtures. Fully described at page 63.

FINE QUALITY, guaranteed germination : 98 per cent. ... Per lb. 10^d.
FINEST QUALITY, do. do. 98 do. ... Do. 1s.

CHICORY (*Cichorium intybus*). More than a century ago this plant was held in the greatest esteem by Arthur Young, who wrote of it : "On all poor lands it is of the highest consequence, having no rival. On the very worst soils it is beneficial for sheep, and I may venture to assert that on such a full stock of sheep cannot be kept without it." He further gives as his reasons for advocating its use : "(1) The greatness of its produce for soiling on good land. (2) Its yielding so amply in feeding sheep on all soils. (3) Its being remarkably applicable in the very poorest and most barren chalks and sands. (4) Its forming a most profitable change on all lands upon which Clover fails from too often repetition."

Chicory forms one of the most important constituents in the mixtures used by Mr. R. H. Elliot in the Clifton Park system of grass-growing, as, in addition to its great value as one of the most productive and best of fodder plants, its roots have the remarkable quality of penetrating and breaking up the sub-soil to a depth of 3 to 4 feet. The capacity of its roots for piercing the hardest pan is astonishing. Drawing its supplies of moisture from a great depth it thrives during extreme drought, while it succeeds equally well in a wet season. Sheep, cattle and horses are all fond of it, and do well upon it, and it greatly increases the flow of milk. 3 to 5 lbs. of Chicory is the quantity usually included in grass seed mixtures. See fig. 28.

FINEST QUALITY, guaranteed germination : 80 per cent. ... Per lb. 10^d.

BURNET (*Poterium Sanguisorba*). This plant was also recommended by Arthur Young as of great value for sheep-grazing, and for its deep-rooting, drought-resisting, and medicinal qualities. It thrives on any land, but more particularly on dry soils. It is very productive, and should be kept constantly grazed, as when the growth is old and woody, it is not relished as it is in its young state. It is said to give an agreeable flavour to butter, and cows eat it freely ; it is also beneficial in the case of sheep affected by scour. Its deep-rooting, drought-resisting qualities secure for it an important place in the Clifton Park system. 6 lbs. to 8 lbs. is the quantity usually sown with grass mixtures. See fig. 26.

N.B.—Burnet and Sainfoin seeds are harvested together, and it is impossible to make a perfect separation of them. The Burnet seed offered is therefore not guaranteed pure, as it contains some Sainfoin seeds, but as the latter is equally valuable in a pasture, it is in no way detrimental to the crop. (Some of the capsules of Burnet contain two kernels, hence the percentage of germination being more than 100 per cent.)

FINEST QUALITY, guaranteed germination : 150 per cent. ... Per lb. 8^d.

YARROW (*Achillea Millefolium*). Thrives in the poorest and driest soils, as well as in those that are heavy and wet. Should be included in all mixtures for permanent pastures. The Yarrow is of great value in the Clifton Park system on account of the mass of rootage it produces. For seed mixtures which are intended to remain down not more than six years, $\frac{1}{2}$ lb. to 1 lb. per acre may be used, but for permanent pastures intended to remain down for many years, not more than $\frac{1}{4}$ lb. per acre should be sown. Fully described at page 63.

FINEST QUALITY, guaranteed germination : 95 per cent. ... Per lb. 7s.
FINE QUALITY, do. do. 85 do. ... do. 6s.

LUCERNE (*Medicago sativa*). On light, loose, dry or chalky soils, *Lucerne* thrives and produces frequent cuttings of green fodder. The roots penetrate so deeply into the soil that no drought can affect the plant, so that when once established it is always a certain crop even in the driest seasons. The first cutting of the season is ready about three weeks earlier than Red Clover, and three or four good cuttings in the year are usually obtained. All stock like it, either green or as hay. Sow the seed during April or May, either in drills one foot apart, or broadcast, seeding with one bushel of barley per acre. When sown in drills it should be kept clean by hoeing every year, and in this way it lasts 10 or 12 years ; but sowing broadcast is less costly, while the result is equally satisfactory, provided due care be taken to sow on clean land. Whether grown in drills or broadcast *Lucerne* should be liberally manured every year with rich farm-yard manure. This treatment is amply repaid by the large and valuable crops produced. 16 lbs. of seed will sow a statute acre in drills, or 24 lbs. broadcast. Sir J. B. Lawes recommended the addition of *Lucerne* to permanent grass mixtures, and the permanence, productiveness, and early growth of this plant renders it valuable for this purpose, particularly on dry and chalky soils. 2 lbs. to 3 lbs. per acre is a suitable quantity for mixture with permanent pasture seeds. The best *Lucerne* seed is the Provence. American *Lucerne*, although cheaper, is much inferior for use in this country. See fig. 36.

FINE QUALITY GENUINE PROVENCE LUCERNE,
 guaranteed germination : 98 per cent. ... Per lb. 1s. 0^d.
FINEST QUALITY do. do., do. do. 98 do. ... do. 1s. 2^d.

SAINFOIN (*Onobrychis sativa*).

Much grown on chalky soils, where it yields a large quantity of fodder. Sainfoin seed in the husk is frequently mixed with seeds of Burnet, and as the latter plant is prejudicial to the Sainfoin crop, it is recommended that "milled" seed (separated from the husk) be used, if pure unmilled seed cannot be had. The milled seed may be had quite pure. Sow 56lbs. milled seed or 4 to 5 bushels unmilled seed per acre, in drills 12 inches apart, or broadcast, at the end of March or early in April, on land that is thoroughly clean and in good heart. See fig. 39.

GIANT or DOUBLE-YIELDING.—The variety to sow for one or two years. It yields two cuttings in a season.

COMMON ENGLISH.—Gives one crop in a season, but is perennial, and may remain down for a period of years.

At Current Market Prices.

TRIFOLIUM INCARNATUM (*Italian, or Crimson Clover*).

Useful for sowing on stubbles, or on bare patches in spring-sown Clovers. Being of rapid growth, it will, when sown in autumn, produce a heavy crop of green food early in May, after which the land may be prepared for Turnips, Rape, Cabbage, etc.; or if left for hay it is fit for mowing early in June. It may be sown alone or in mixture with Italian Rye-grass. August is the best time to sow the seed. The *Early Red* is the kind generally grown. The *Late Red* variety is useful for succession. Quantity of seed required per statute acre:—24 lbs. Trifolium when sown alone, or 16 lbs. Trifolium and 1 bushel Italian Rye-grass when sown in mixture. See fig. 37. At Market Price.

WHITE MUSTARD (*Sinapis alba*).

Useful for sheep feed or for ploughing down as manure. Being of quick growth, it may with advantage be employed in keeping down weeds, as well as for producing a crop. Fallow lands and stubbles are profitably cropped with it. May be sown from April to August. 20 lbs. of seed is the quantity required for a statute acre, sown broadcast. See fig. 38.

FINEST QUALITY, guaranteed germination: 98 per cent. Per lb. 4d.; per cwt. 32s.

RAPE (*Brassica napus*).

Valuable as green food for cattle and sheep in winter and spring. In some districts it is also largely grown for seed, and it may be profitably sown on summer fallows or stubbles. This plant is very hardy, and never fails on any soil. It is well suited for sowing with grass and clover seeds when laying down land to permanent pasture, and for this purpose it is, in many cases, preferred to a corn crop, as a thin seeding of Rape (3 lbs. or 4 lbs. per acre) affords the requisite shelter and protection to the young grasses and clovers without retarding their growth, and at the same time it yields very profitable grazing for sheep. Time of sowing:—With permanent grass seeds—from April to September; for other purposes—during July and August. Quantity of seed per statute acre when sown alone—6 lbs. if drilled, and 12 lbs. broadcast.

FINEST QUALITY BROAD-LEAVED WINTER RAPE,

guaranteed germination: 98 per cent. Per lb. 3d.; per cwt. 25s.

BUCKWHEAT (*Polygonum Fagopyrum*).

Grows well on poor, light, or sandy soils, and is scarcely affected by the most severe drought. It is useful as fodder in a green state, all stock being fond of it, and milch cows yield an abundance of milk of superior quality when fed with it. The ripe seed is excellent for fattening fowls, and pigs are extravagantly fond of it. Buckwheat is also sown in or near game preserves for feeding pheasants and partridges during winter, and affords them both food and shelter. It is also grown for manure, and in this case it is ploughed in when it is in flower. The seed should not be sown until May, when there is no longer any danger of the young plants being injured by frost. Two bushels will sow a statute acre. See fig. 40. At Current Market Price.

PARSLEY (*Petroselinum sativum*).

Useful in mixtures of seeds sown for grazing. It is also sown in pastures to attract hares, which are very fond of it. It is liked by all herbivorous animals, and is said to be a preventive of liver rot in sheep. Sow 1 lb. per acre with grass and clover mixtures. See fig. 41.

FIELD or SHEEP'S PARSLEY, germination: 90 per cent. ... Per lb. 6d.

GORSE or FURZE (*Ulex Europæus*).

Chiefly grown for game cover, but is also cultivated for winter food for horses, cattle, and sheep. It thrives on the poorest and most worthless soils. When used as food, the shoots should be cut while young, and thoroughly bruised to destroy the prickles, so that stock may eat them with comfort. In hilly districts it is sown for fences, two or three lines being usually sown to form a fence. The seed may be sown from February until May, in drills one foot apart, either with or without a light corn crop. 20 lbs. of seed is sufficient to sow a statute acre for cover, and 25 lbs. per acre for fodder. See fig. 42.

FINEST QUALITY FRENCH GORSE, germination: 90 per cent. ... Per lb. 2s. 6d.

THOUSAND-HEADED KALE, *Russell's stock.*

duces enormous crops, and may be fed off two or three times. In severe winters, or when other winter and spring food is scarce, this crop, which is usually an unfailing one, proves of the greatest value. Sheep and lambs do remarkably well on it. The seed should be drilled, during April, to come in for use in autumn and early winter, and in August for use in the following spring and summer, in rows 27 to 30 inches apart, and the plants afterwards set out 20 to 24 inches distant in the rows. 4 lbs. of seed will drill a statute acre. The Thousand-headed Kale is unaffected by the severest frosts. *Guaranteed germination : 95 per cent. Per lb. 1s.*

KOHL RABI, *Improved Large Green Short-top.*

are fond of the Kohl Rabi, or Turnip-rooted Cabbage. It is a hardy plant, is not subject to the attack of insects, and withstands severe drought without injury or ceasing to grow. It transplants as readily as a Cabbage, and on this account it is useful for filling up gaps in Swedes or Mangels. It grows best on light or loamy soils, and the land should be prepared as for Turnips. Kohl Rabi is highly nutritious, and when stored will keep good until June. The seed should be sown from the beginning to the end of April, either broadcast for transplanting, or drilled where the crop is intended to grow. The latter is the cheaper mode. The quantity of seed required to drill a statute acre is 3 lbs.; or 1 lb. of seed will produce sufficient plants for transplanting on 1 acre. *Germination : 98 per cent. Per lb. 2s.*

CABBAGE.

Grown as a field crop the Cabbage is both useful and profitable. It will grow on almost any soil, but succeeds best on those soils which are good, strong, and free. To obtain a heavy crop, plenty of manure should be used. Being perfectly hardy, the cabbage comes in usefully for spring food for cows, sheep and lambs. When milch cows are fed on cabbages the yield of milk is very abundant.

LARGE LATE DRUMHEAD.—This variety grows to an enormous size, and produces a great weight of crop per acre. The seed should be sown in August to supply plants for transplanting in spring, to come in for use in summer and autumn, and in March and April for transplanting during summer for winter use. 1 lb. to 1½ lbs. of seed will produce sufficient plants for a statute acre. *Guaranteed germination : 95 per cent. Per lb. 2s.*

ENFIELD MARKET.—An early large-growing kind, suitable for field planting. The seed may be sown the same times as recommended for the *Large Late Drumhead*, but the crop will be ready for use much earlier than that variety. 2 lbs. of seed will produce sufficient plants for a statute acre. *Guaranteed germination : 95 per cent. Per lb. 2s. 6d.*

CARROT.

A field crop of Carrots is a most profitable one on sandy, light, or medium soils, and the roots are relished by all kinds of stock. The beginning of April is the best time to sow Carrot seed, but if the weather be unfavourable and the soil cold and wet, sowing may be deferred for a short time. Carrots are best grown in drills, as the crop can be kept clean at less expense than when grown broadcast.

The quantity of clean Carrot seed required to sow a statute acre is 6 lbs.

ALTRINGHAM CARROT (Select Stock).—This is the best red Carrot for field culture on deep soils. The weight of crop is very large as the roots are long, thick, and solid, and there is very little waste. The stock offered is a splendid selection, and cannot be surpassed for excellence of quality and weight of crop *Per lb. 2s. 6d.*

JAMES'S INTERMEDIATE CARROT (Select Stock).—For shallow soils this is the best variety to grow, as its roots, being only about two-thirds the length of the *Altringham*, do not penetrate the soil so deeply. Notwithstanding its shorter length, the *Intermediate* Carrot produces a large crop per acre, the roots being so thick and solid *Per lb. 2s. 6d.*

WHITE BELGIAN CARROT (Select Stock).—The *White Belgian* is the largest Carrot, and produces the heaviest crops. It is a very free grower and thrives on all soils, but the feeding quality is scarcely equal to that of the red sorts. The roots are very handsome, and in addition to their penetrating deeply into the soil, they also grow about six inches above ground, which enables them to attain a very large size *Per lb. 1s. 6d.*

Guaranteed germination of the above Carrot Seeds : 75 to 85 per cent. They are all clean, rubbed seeds, free from beard, and are more readily sown, and go farther, than unrubbed seeds.

Grasses and Clovers for Renovating Permanent Pastures.—

When permanent pastures, by improper management, or from having been laid down with an injudicious selection of seeds, become thin and unproductive, and it is inconvenient to break up and lay down anew, an application of about fourteen pounds of the best permanent Grasses and Clovers per statute acre will often prove beneficial. The seeds may be sown during March or early in April, and during August and September. Renovating seeds may be sown earlier in the season than is recommended for laying down land afresh, as the young plants will have the shelter of the established grasses, and it is desirable to have them growing before the old grasses begin to cover the ground. Before sowing, the turf should be scarified, both lengthwise and across the field, with a toothed harrow, a top-dressing of compost and soil if possible being given. After the seeds have been sown and lightly harrowed in, the surface should be well rolled.

RENOVATING MIXTURE OF BEST PERMANENT GRASSES AND CLOVERS,
for Medium, Heavy, and Light Soils *Per lb. 1s. 2d.; per cwt. 125s.*

The description of soil should be stated when ordering these seeds.

MANGEL WURZEL.

The usual time for sowing Mangel seed is from the middle to the end of April, although in some districts it may be desirable to sow earlier or later than this. Very early sowing induces running to seed, but a heavy crop of roots cannot be obtained from seed sown late in the season, so that it is important to sow at the right time—neither too early nor too late, and it is well to observe the usual custom of the district in regard to the time of sowing. Quantity of seed required to sow a statute acre, 6lbs. to 7lbs.

The Mangel Seed Crops of 1909 were injuriously affected by the wet unfavourable season, and such seed as was harvested is mostly of inferior quality and low germination. We are fortunate in being able to offer all the varieties of exceptionally high germination—160 to 200 per cent.—a matter of the very first importance in the case of Mangel seed.

Prizewinner Yellow Globe Mangel.—Succeeds on all soils, and produces heavy crops of cleanly-grown and handsome roots, free from much waste. A very fine stock.

Per lb., 1s. Per cwt., 105s.

Hurst's Monarch Yellow Globe Mangel.—An improved variety of great excellence, both as regards heavy cropping and fine quality of the roots.

Per lb., 1s. Per cwt., 105s.

Cornish Short-top Yellow Globe Mangel.—A very superior variety and the best for the West of England.

Per lb., 1s. Per cwt., 105s.

Mammoth Long Red Mangel.—This is the heaviest cropping Mangel, and is most suitable for growing on rich, deep, or heavy soils. In the selection of this variety the qualities sought have been the greatest weight, with absence of superabundant top and roots, and the stock now offered can be highly recommended as possessing these qualities in an eminent degree.

Per lb., 10d. Per cwt., 88s.

Yellow Intermediate or Gatepost Mangel.—An excellent variety, suitable for lighter and shallower soils. The roots are of oval shape, are very handsome, and of fine quality.

Per lb., 1s. Per cwt., 105s.

Golden Tankard Mangel.—This beautiful Mangel possesses the highest feeding properties, and the roots are very handsome and of the finest quality. The colour of the rind is a deep reddish orange, and the flesh is yellow. Although not growing so large as the *Yellow Globe* variety, heavy crops of the *Golden Tankard* can be raised, as the roots may be grown closer together than those of any other sort.

Per lb., 1s. 2d. Per cwt., 120s.

Guaranteed germination of the above-named Mangels : 160 to 200 per cent.

N.B.—Two or three seeds of Mangel are usually contained in one capsule, and in testing the germination the number of plants produced from 100 capsules is reckoned.

The Purity, Genulneness, and percentage of Germination of all Seeds is Guaranteed.

SWEDE SEEDS.

The time of sowing Swede seed, which extends from the beginning of May for Scotland, to the end of June for the South of England, depends on the district, and the usual practice of the neighbourhood in regard to time of sowing should be observed.

Quantity of seed required per statute acre :—3 to 4 lbs.

The undernoted varieties represent the finest types in cultivation.

Monarch Purple-top Swede.—A new and distinct variety of the highest merit.

It is of oblong shape, standing well above ground, and being of a rich plum colour, a field of this Swede has a magnificent appearance, and the weight of crop it produces is very great. Since its introduction a few years ago, this Swede has become very popular, and its heavy cropping and general good qualities entitle it to rank as one of the best varieties grown, particularly for early use. Recommended for early winter and mid-winter consumption.

Per lb. 10d. Per cwt. 84s.

Purple-top Swede.—A handsome variety of Swede, large in size, with moderate neck and top, and free from superabundant roots. It is of hardy constitution and an excellent keeper. The colour of the rind is deep purple, and that of the flesh yellow. Recommended for winter and spring consumption.

Per lb. 8d. Per cwt. 68s.

Ne Plus Ultra Bronze-top Swede.—A new Swede of exceptional merit. It is a bronze-top, globular in shape, symmetrical in form, of splendid quality, a quick grower, and very heavy cropper. In appearance it is quite distinct from any other variety, not only as regards root, but its short neck, small top, and light coloured foliage distinguish it from other varieties, and help to make a field of *Ne Plus Ultra* the most attractive crop of Swede on the farm.

Per lb. 10d. Per cwt. 84s.

Lord Derby Bronze-top Swede.—A large-growing hardy Swede, possessing long-keeping and excellent feeding properties. Very carefully selected stock.

Per lb. 9d. Per cwt. 75s.

Green-top Swede.—No variety of Swede equals this for extreme hardiness and long-keeping qualities. Its feeding properties are also unsurpassed, the flesh being very solid, and rich in saccharine matter. It is valuable to come in for use late in spring, after the purple-top Swedes have been consumed.

Per lb. 9d. Per cwt. 75s.

Best of All Swede (*Tait's*).—A recently introduced variety of Purple-top Swede which has become very popular in the North of England and in Scotland. Its marked success when grown in competition with other varieties affords proof of its superior merit and heavy cropping quality.

Per lb. 9d. Per cwt. 75s.

Guaranteed germination of the above-named Swedes : 95 to 98 per cent.

The Purity, Genuineness, and percentage of Germination of all Seeds is Guaranteed.

Seeds of over £1 value are sent Carriage Free. Five per cent. discount is allowed for cash in Fourteen Days.

Yellow Turnips.

The Yellow-fleshed Turnips may be sown after it is too late to sow Swedes; and in seasons when the Swede plant has been taken by the fly or has failed, Yellow-fleshed Turnips may be sown with great advantage. In Scotland, particularly in the north, where they are grown almost to the exclusion of Swedes, they produce very heavy crops, and their feeding properties and long-keeping qualities are excellent. In England, the Yellow-fleshed Scotch varieties do not thrive so well as they do in Scotland, and particularly in the southern and eastern districts where the climate is too hot and dry for them, but there the *Fosterton Hybrid* succeeds much better. The Yellow-fleshed Turnips enumerated below are the best and most distinct types of this section.

Green-top Yellow, or Scotch Turnip.—A fine selection of this favourite variety. It grows large, is of excellent feeding quality, and is valuable for winter use. The time for sowing varies according to the locality, early in June suiting for Scotland, while July is the best month for sowing in England.

Per lb. 9d. Per cwt. 75s.

Fosterton Hybrid Turnip.—This variety resembles the *Green-top Yellow* in colour and general appearance, but it grows larger and quicker, and may therefore be sown later. Being a large and rapid grower, it is naturally less hardy than the slower growing Scotch varieties, particularly if it be sown early, and on this account the roots should be stored early in December. It is very useful for consumption during the early winter months, and is valuable for sowing in hot and dry districts, where the Scotch varieties do not succeed.

Per lb. 9d. Per cwt. 75s.

Yellow Tankard Turnip.—A long shaped, pale yellow-fleshed Turnip of rapid growth, which may be sown any time during July, and even until the middle of August. When sown late, it should be drilled closer and the plants left thicker than when sown early in the season, so that the greatest weight of roots may be obtained. When sown late, the roots keep good until spring; but if sown early they should be used during the winter months.

Per lb. 9d. Per cwt. 75s.

White Turnips.

The White-fleshed Turnips being of rapid growth, soon reach maturity, and are very useful either for early or very late sowing. They may be sown from the beginning of June until the end of August, and small successional sowings should be made in preference to large sowings at one time, so that the rate of production may not exceed the power of consumption. When allowed to grow very large they are invariably dry and spongy, and possess little feeding value, so that what they gain in size does not compensate for what they lose in quality, and it is desirable therefore to use them when they have attained a moderate size and while they are still juicy and nutritious.

The undermentioned varieties are the most distinct and useful White-fleshed Turnips. Early sowings of any of these varieties may be made for consumption in autumn, and late sowings for late use. The latest sown will keep much better than those sown early.

Green Globe Turnip.—This is the hardest of the White-fleshed Turnips. It is of excellent quality, and is valuable either for early or late sowing.

Per lb. 8d. Per cwt. 68s.

Purple-top Mammoth Turnip.—A superior variety; grows very large, suitable for early or late sowing.

Per lb. 8d. Per cwt. 68s.

Red Globe Turnip.—An excellent variety suitable either for early or late sowing.

Per lb. 8d. Per cwt. 68s.

Early White Stone Turnip.—The quickest growing Turnip, and it may therefore be sown either earliest or latest of all. Useful for sowing on stubbles, &c.

Per lb. 8d. Per cwt. 68s.

Guaranteed germination of the above-named Turnips: 95 to 98 per cent.

FINE-LEAVED DWARF-GROWING GRASSES FOR LAWNS, LAWN TENNIS AND CROQUET GROUNDS, &c.

Mixture of fine-leaved dwarf-growing grass seeds (without Rye-grass or Clover), of guaranteed purity, genuineness, and germination, for Lawns, Lawn Tennis and Croquet Grounds, Putting Greens, &c. Per lb., 1s. 10d.; per cwt., 195s.

Small quantities sent free by Parcel Post at the following rates:—1lb. 2s. 2d.; 2lbs. 4s.; 3lbs. 5s. 9d.; 4lbs. 7s. 8d.; 5lbs. 9s. 6d.; 6lbs. 11s. 3d.; 7lbs. 13s.; 8lbs. and upwards at 1s. 10d. per lb.

The formation of a perfect lawn requires a good deal of care—much more than is usually given to the work—and it too often happens that disappointment is caused by the omission of some detail which should have received attention before the lawn seeds were sown. One of the most frequent causes of disappointment is the sowing of lawn seeds on ground which already contains seeds of weeds and coarse grasses, with the result that weeds and lawn grasses come up together, and the former must then be got rid of by hand weeding.

Preparation of the ground.—The ground to be sown should be drained, if necessary, then trenched and manured, and, if practicable, a crop of potatoes or other cleansing crop grown to clean the land and improve its physical condition. An equal depth of the best soil should cover the entire surface to be sown, and this surface soil should be of uniform quality throughout, otherwise the lawn may afterwards have a patchy appearance. The ground should be made either perfectly level, sloping, or gently undulating, as circumstances may require, but the after labour of mowing and rolling is greatly lessened when a lawn is quite level, or as nearly so as possible.

Lawn seeds should be sown on clean ground.—When ground has been newly dug the presence of weed seeds may not be suspected, but if the ground be left undisturbed a sufficient time after being prepared, a growth of some kind is sure to appear, so that if lawn seeds are sown immediately after the ground has been dug, and without any preparatory cleansing, weeds and lawn grasses germinate together, and hand weeding must be resorted to as soon as the weeds appear, and they must never be allowed to predominate, otherwise the lawn will be spoiled. It is evident, therefore, that the ground must either be quite clean and free from weed seeds before the lawn seeds are sown, or, if not, then the labour of weeding must be incurred.

Thick sowing is necessary for the production of a fine close turf. Early in April, or during August and until the middle of September, are the best times to sow the seeds, but they may also be sown during the months of May, June, and July, if the weather be not too hot and dry. Quantity of seed required :

1 lb. will sow	50 square yards.
2 „ „	100 „
4 „ „	200 „
8 „ „	450 „

16 lbs. will sow	900 square yards.
20 „ „	1200 „
40 „ „	$\frac{1}{2}$ a statute acre.
80 „ „	1 statute acre.

The Clifton Park System of Farming

— and —

Laying down Land to Grass.

BY

ROBERT H. ELLIOT,

Author of "The Experiences of a Planter," "Gold, Sport, and Coffee Planting in Mysore," etc.

Being the Fourth Edition (with notes of Experiences up to November, 1907) of
"THE AGRICULTURAL CHANGES REQUIRED BY THESE TIMES."

Revised and very much Enlarged, with Illustrations, and Map of Clifton-on-Bowmont Experimental and Demonstration Farm (1250 acres), and Experiences up to the end of November, 1907. Pp. xxxii., and 260.

Price 3s. 6d. Net. Post Free, 3s. 10d.

LONDON: SIMPKIN, MARSHALL, HAMILTON, KENT, & Co., LTD.

KELSO: J. & J. H. RUTHERFURD, 20, SQUARE.

An account of the Clifton Park Farming System, wherein is recorded the Experiments in Grass Growing on Clifton-on-Bowmont Farm, Roxburghshire, from 1887 to the end of 1907; the successful production of Corn, Clover, Turnip, and Potato Crops without the aid of Manure other than that produced on the land by the agency of the Deep-Rooting Grasses and Plants used in this System.

In 1898 the First Edition was printed in Booklet form for private circulation, but a general demand for the work led to the publication, in 1901, of a revised and extended Second Edition. The further development of the System and the great interest taken in the Experiments carried out at Clifton-on-Bowmont (as evidenced by the demand for the book, and the visits of hundreds of Agriculturists, who have inspected the Farm in recent years), induced Mr. Elliot, in 1904, to prepare a Third and further enlarged Edition. This is now followed by the issue of a Fourth Edition, which has been considerably extended and brought up to date, with notes of the latest experiences of the system, up to the end of November, 1907.

Clifton-on-Bowmont Farm is always open to the inspection of visitors. The Steward will accompany visitors round the Farm. He should be advised of proposed time of arrival. Post Town, Yetholm ($1\frac{1}{2}$ miles). Railway Stations, Kelso ($8\frac{1}{2}$ miles), Mindrum (6 miles).

THE CLIFTON PARK SYSTEM.

The Clifton Park System of Grass-growing is now so extensively practised in the three kingdoms, and its merits and advantages are so fully acknowledged, that we feel amply justified in devoting a considerable portion of our Price List in elucidation of the system, and in giving particulars of the seed mixtures that have been so successfully used by Mr. Elliot at Clifton-on-Bowmont. The most notable of Mr. Elliot's seed mixtures with which he has experimented during the past 20 years are :

(1) The "**Inner Kaimrig**" Mixture, sown on 25 acres poor land in 1895. For particulars of this mixture, and the reports of the Cambridge University Agricultural Department upon its results at Abbotsley, *see* page 22. An "**Improved Inner Kaimrig**" Mixture is now suggested by Mr. Elliot, *see* page 23.

(2) The "**Bankfield**" Mixture, sown on 27 acres poor land in 1900. For particulars of this mixture *see* page 24. The Bankfield was grazed in autumn, 1900 (the year of sowing) and again in spring, 1901. It produced a heavy crop of hay in June, 1901, and was grazed in the summer and autumn of the same year. Notwithstanding this severe treatment, the Bankfield, which has been grazed from 1902 to the end of 1908, has excited the interest of hundreds of visitors who have been struck by the wonderful production of grass and clover, and by the unusually large head of stock which it has carried, quite irrespective of drought or other circumstance.

A modification of the "**Bankfield**" Mixture, for good land at a moderate elevation, suggested by Mr. Hunter and approved by Mr. Elliot, is also given on page 24.

It may be convenient to state briefly the rotation of cropping on the Clifton Park System :

1ST ROTATION:—After turnips lay down with (1) Oats or Barley (Wheat is little grown in this district), and a mixture of strong-growing, deep-rooting grasses and plants, to remain down four or five years, or longer, according to the condition of the grass and the requirements of the farm. The turf is then ploughed, and an immense quantity of rootage from the large grasses, Yarrow, Kidney Vetch, &c., provides an ample supply of vegetable matter, as well as nitrogen stored in the nodules on the roots of the Kidney Vetch and Clovers, for the succeeding root and cereal crops of the rotation.

(2) Turnips, followed by (3) Oats, followed by (4) Turnips.

2ND ROTATION:—The land is laid down a second time, as described above, with (1) Oats or Barley, and again broken up in four to six years, followed by the usual rotation of (2) Turnips, (3) Oats, (4) Turnips, when the **3RD ROTATION** (which is a repetition of the 1st and 2nd) is begun.

The Turnip crop taken after the first breaking up of the grass receives artificial manure, and no manure of any kind is given to the succeeding crops of the rotation—the decaying vegetable matter from the turf being amply sufficient. At the breaking up of the second turf Turnips and Potatoes have been successfully grown without any manure whatever, and the soil is by that time charged with humus, the ploughing depth has been much increased, and the rental value of the land largely enhanced—in some instances trebled.

The whole subject is very fully treated by Mr. Elliot in the 4th Edition of his book "**The Clifton Park System of Farming**," Simpkin & Co., London, 1908. See announcement on page 19.

Copies of Mr. James Hunter's Lecture on the "**Clifton Park System of Grass-growing**" may be had gratis on application.

SELECTION OF SEEDS recommended by Mr. R. H. ELLIOT for laying down POOR, HIGH-LYING DRY SOILS for TWO or more YEARS, preparatory to laying down one of his more elaborate and expensive mixtures; or where it is thought undesirable to incur the cost of one of these expensive seedings when commencing the system.

ELLIOT'S SELECTION FOR 2 YEARS, No. 1.	Quantity of Seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.
	lbs.	per cent.		s. d.
Cocksfoot (<i>Dactylis glomerata</i>).....	14	90	5,367,600	16 4
Hard Fescue (<i>Festuca duriuscula</i>)	2	94	1,086,640	2 0
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	1	96	2,145,600	1 4
Alsike Clover (<i>Trifolium hybridum</i>).....	1	98	703,640	1 0
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2 8
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2 4
Chicory (<i>Cichorium intybus</i>).....	3	80	804,000	2 6
	25	...	11,969,480	28 2

Price per Acre for
Guaranteed Seeds of
Finest Quality. { For 100 Acres or upwards26s. 0d.
For 50 to 99 Acres26s. 9d.
For 20 to 49 Acres27s. 6d.
For less than 20 Acres28s. 2d. } Carriage Paid.
Five per cent. discount
for cash in 14 days.

SELECTION OF SEEDS for laying down POOR LAND, at a LOWER ELEVATION, for TWO or MORE YEARS.

ELLIOT'S SELECTION FOR 2 YEARS, No. 2.	Quantity of Seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.
	lbs.	per cent.		s. d.
Cocksfoot (<i>Dactylis glomerata</i>).....	12	90	4,600,800	14 0
Timothy Grass (<i>Phleum pratense</i>).....	3	98	3,880,800	1 4½
Meadow Fescue (<i>Festuca pratensis</i>)	2	98	462,560	3 0
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	1	96	2,145,600	1 4
Alsike Clover (<i>Trifolium hybridum</i>).....	1	98	703,640	1 0
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2 8
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2 4
Chicory (<i>Cichorium intybus</i>).....	3	80	804,000	2 6
	26	...	14,459,400	28 2½

Price per Acre for
Guaranteed Seeds of
Finest Quality. { For 100 Acres or upwards ... 26s. 0d.
For 50 to 99 Acres 26s. 9d.
For 20 to 49 Acres 27s. 6d.
For less than 20 Acres 28s. 2d. } Carriage Paid.
Five per cent. discount
for cash in 14 days.

N.B.—The valuable deep-rooting forage plants, Sainfoin and Lucerne, are not included in the seed mixtures used by Mr. R. H. Elliot at the Clifton-on-Bowmont Experiment and Demonstration Farm, Roxburghshire, because of their unsuitability to that district, but this should not prevent their use in England, and particularly on chalk formations, where Sainfoin and Lucerne are among the most valuable and productive forage plants grown. Both these plants are admirably suited for the Clifton Park System, and their inclusion in seed mixtures for soils naturally suitable for them is strongly recommended. On the chalk soils of the eastern and southern counties of England an equal weight of Sainfoin seed may be profitably substituted for the Burnet seed included in Clifton Park Mixtures.

MR. R. H. ELLIOT'S SELECTION OF SEEDS, used in 1895, for laying down 25 acres poor land (the Inner Kaimrig Field, 600 feet).

KAIMRIG SELECTION.	Quantity of Seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.	
	lbs.	per cent.		s.	d.
Cocksfoot (<i>Dactylis glomerata</i>)	6	90	2,300,400	7	0
Meadow Fescue (<i>Festuca pratensis</i>)	5	98	1,156,400	7	6
Tall Fescue (<i>Festuca elatior</i>)	4	94	924,960	6	0
Tall Oat-like Grass (<i>Avena elatior</i>)	3	90	372,600	3	6
Hard Fescue (<i>Festuca duriuscula</i>)	2	94	1,086,640	2	0
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	$\frac{1}{2}$	96	1,072,800	0	8
Smooth-stalked Mead. Grass (<i>Poa pratensis</i>)	2	85	3,162,000	2	4
Golden Oat Grass (<i>Avena flavescens</i>)	$\frac{1}{2}$	80	560,000	1	7 $\frac{1}{2}$
Italian Rye-Grass (<i>Lolium italicum</i>)	4	90	972,000	1	6
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2	4
Alsike Clover (<i>Trifolium hybridum</i>)	2	98	1,407,280	2	0
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2	8
Kidney Vetch (<i>Anthyllis vulneraria</i>)	2 $\frac{1}{2}$	98	472,850	2	6
Chicory (<i>Cichorium intybus</i>)	2	80	536,000	1	8
Burnet (<i>Poterium Sanguisorba</i>)	8	150	648,000	5	4
Sheep's Parsley (<i>Petroselinum sativum</i>)	1	90	207,000	0	6
Yarrow (<i>Achillea Millefolium</i>)	1	95	3,334,500	7	0
	47 $\frac{1}{2}$	...	20,075,430	56	1 $\frac{1}{2}$

Price per acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards ...	52s. 0d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres.....	53s. 4d.	
	For 20 to 49 Acres.....	54s. 8d.	
	For less than 20 Acres.....	56s. 1d.	

The above Seed Mixture has been sown in many parts of the three kingdoms with great success, but the "Improved Inner Kaimrig Mixture" (see next page) is now recommended to take its place.

At Abbotsley, Hunts, in 1900, the original Mixture was sown, along with seven other Seed Mixtures, by the University of Cambridge Agricultural Department, on a field of eight acres of poor clay soil, and the superiority of the Inner Kaimrig Mixture over all the other Mixtures will be gathered from the Annual Reports of the Department which here follow :—

June, 1903.—"On the poor clay soil of Abbotsley eight different mixtures have been tried, and at the present time Elliot's is much the most promising. The soil is now evenly covered with herbage, which looks as if it would be permanent. None of the other mixtures have, so far, produced a close turf."

June, 1904.—"Much the best of the pastures, a close even sward, closely grazed by stock."

June, 1905.—"The best of the pastures; surface evenly covered; herbage much liked by stock, and always closely grazed."

November, 1905.—Professor Middleton, writing in the Journal of the Board of Agriculture, says :—"In placing the Abbotsley plots in order of merit we may say :—No. VIII. (Mr. R. H. Elliot's 1895 Mixture) first, the others nowhere."

IMPROVED INNER KAIMRIG MIXTURE.

In the New Edition of his book "The Clifton Park System of Farming," Mr. Elliot writes:—"If I now (1907) had to lay down this field, I would use the following improved mixture, as the experience of the last twelve years has shown me that a better mixture can be made without increasing the cost of the seeds used; indeed, the cost of this improved mixture will in most years be rather less than that of the original mixture."

IMPROVED KAIMRIG SELECTION.	Quantity of Seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.	
	lbs.	per cent.		s.	d.
Cocksfoot (<i>Dactylis glomerata</i>)	10	90	3,834,000	11	8
Meadow Fescue (<i>Festuca pratensis</i>).....	5	98	1,156,400	7	6
Tall Fescue (<i>Festuca elatior</i>)	4	94	924,960	6	0
Tall Oat-like Grass (<i>Avena elatior</i>).....	3	90	372,600	3	6
Hard Fescue (<i>Festuca duriuscula</i>)	1	94	543,320	1	0
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	$\frac{1}{2}$	96	1,072,800	0	8
Smooth-stalked Mead. Grass (<i>Poa pratensis</i>)	1	85	1,581,000	1	2
Golden Oat Grass (<i>Avena flavescens</i>)	$\frac{1}{2}$	80	560,000	1	7 $\frac{1}{2}$
Italian Rye-Grass (<i>Lolium italicum</i>)	3	90	729,000	1	1 $\frac{1}{2}$
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2	4
Alsike Clover (<i>Trifolium hybridum</i>)	1	98	703,640	1	0
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2	8
Kidney Vetch (<i>Anthyllis vulneraria</i>)	2 $\frac{1}{2}$	98	472,850	2	6
Chicory (<i>Cichorium intybus</i>)	3	80	804,000	2	6
Burnet (<i>Poterium Sanguisorba</i>)	8	150	648,000	5	4
Sheep's Parsley (<i>Petroselinum sativum</i>)	1	90	207,000	0	6
Yarrow (<i>Achillea Millefolium</i>)	$\frac{1}{2}$	95	1,667,250	3	6
	48	...	17,138,820	54	7

Price per acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards ...	50s. 6d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	51s. 10d.	
	For 20 to 49 Acres	53s. 3d.	
	For less than 20 Acres	54s. 7d.	

We are sometimes asked to name a suitable machine for the sowing of Clifton Park and other Grass Seed Mixtures, and we have pleasure in recommending:

TURNBULL'S BROADCAST SOWING MACHINE FOR GRAIN AND GRASS SEEDS.

One of these machines has been in use at Mr. R. H. Elliot's Clifton-on-Bowmont farm for the last 25 years, and we have been informed by the steward that all the seed grain and grass seed mixtures sown at Clifton-on-Bowmont during that period have been sown by the aid of this machine. He also says that as much as 40 acres can be sown per day, and the machine, after so many years' use, is still in perfect order.

The machine sows the Grass, Clover, Burnet, Chicory, and other seeds composing the Clifton Park mixtures, *all in one mixture, and at one operation*, thus effecting a considerable saving of time; and the equal distribution of all the species leaves nothing to be desired. The machine is equally suitable for the sowing of Seed Corn as for Grass Seed Mixtures.

Price of Machine with 16ft. Seed Box ...	£12 0 0
Do. do. 18ft. do. ...	£13 10 0

Illustrated Price List, giving further particulars, will be sent on application.

THE SOWING OF CLIFTON PARK MIXTURES.—When sowing grass seeds care should be taken to adjust the openings of the sowing machine to the right dimensions so that the proper quantity of seed per acre may be sown. In the case of Clifton Park Mixtures, which are usually larger in quantity, and contain such large-seeded species as Burnet, Tall Oat Grass, &c., which do not pass so freely through the holes of the sowing machine as the smaller-seeded species, *larger openings are necessary* than for ordinary Rye-grass and Clover mixtures.

MR. R. H. ELLIOT'S BANK-FIELD MIXTURE, used in 1900, for laying down the Bank field (500 ft. elevation), see page 20.

N.B.—In Mr. Elliot's opinion the "Bankfield" Mixture has not been surpassed, and the only change he can now suggest by way of improvement, is the addition to the mixture of $\frac{1}{2}$ lb. of Golden Oat Grass. Since 1901, to the end of the year 1908, the Bankfield has been a splendid success, maintaining throughout the whole of the period a large head of stock.

BANKFIELD SELECTION.	Quantity of Seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.
	lbs.	per cent.		s. d.
Cocksfoot (<i>Dactylis glomerata</i>)	14	90	5,367,600	16 4
Tall Fescue (<i>Festuca elatior</i>)	7	94	1,618,680	10 6
Tall Oat-like Grass (<i>Avena elatior</i>).....	7	90	869,400	8 2
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	1	96	2,145,600	1 4
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2 8
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2 4
Alsike Clover (<i>Trifolium hybridum</i>)	1	98	703,640	1 0
Yarrow (<i>Achillea Millefolium</i>)	1	95	3,334,500	7 0
Burnet (<i>Poterium Sanguisorba</i>)	8	150	648,000	5 4
Kidney Vetch (<i>Anthyllis vulneraria</i>)	3	98	567,420	3 0
Chicory (<i>Cichorium intybus</i>)	3	80	804,000	2 6
	49	...	17,920,840	60 2

Price per acre
for
Guaranteed Seeds
of Finest Quality.

{ For 100 Acres or upwards55s. 8d.
For 50 to 99 Acres57s. 2d.
For 20 to 49 Acres58s. 8d.
For less than 20 Acres60s. 2d.

Carriage Paid.
Five per cent. discount
for cash in 14 days.

JAMES HUNTER'S SELECTION of GRASSES and CLOVERS
for LAYING DOWN GOOD LAND, at a moderate elevation, on the
CLIFTON PARK SYSTEM.

HUNTER'S CLIFTON PARK SELECTION.	Quantity of seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Price.
	lbs.	per cent.		s. d.
Cocksfoot (<i>Dactylis glomerata</i>).....	8	90	3,667,200	9 4
Tall Fescue (<i>Festuca elatior</i>).....	4	94	924,960	6 0
Meadow Fescue (<i>Festuca pratensis</i>)	6	98	1,387,680	9 0
Meadow Foxtail (<i>Alopecurus pratensis</i>).....	4	85	1,666,000	5 4
Tall Oat-like Grass (<i>Avena elatior</i>)	4	90	496,800	4 8
Timothy (<i>Phleum pratense</i>)	3	98	3,880,800	1 4 $\frac{1}{2}$
Rough-stalked Meadow Grass (<i>Poa trivialis</i>)	1	96	2,145,600	1 4
Late-flowering Red Clover (<i>Tri. prat. per. var.</i>)	2	98	427,280	2 8
White Clover (<i>Trifolium repens</i>)	2	98	1,434,720	2 4
Alsike Clover (<i>Trifolium hybridum</i>)	1	98	703,640	1 0
Yarrow (<i>Achillea Millefolium</i>)	$\frac{1}{2}$	95	1,667,250	3 6
Burnet (<i>Poterium Sanguisorba</i>)	8	150	648,000	5 4
Kidney Vetch (<i>Anthyllis vulneraria</i>)	3	98	567,420	3 0
Chicory (<i>Cichorium intybus</i>)	3	80	804,000	2 6
	49 $\frac{1}{2}$	...	19,821,350	57 4 $\frac{1}{2}$

Price per acre
for
Guaranteed Seeds
of Finest Quality.

{ For 100 Acres or upwards ...52s. 9d.
For 50 to 99 Acres54s. 3d.
For 20 to 49 Acres55s. 9d.
For less than 20 Acres57s. 4d.

Carriage Paid.
Five per cent. discount
for cash in 14 days.

JAMES HUNTER'S SELECTIONS OF GRASSES AND CLOVERS FOR PERMANENT PASTURE.

THE BEST GRASSES and CLOVERS for PERMANENT PASTURE or MEADOW on Good Medium Soils.

(SELECTION A.—Medium Soil.)

This Selection includes the most nutritive and productive species of Grasses and Clovers suitable for laying down good medium soils to permanent grass. The quantity of each species is carefully regulated with the object of forming pastures that will yield in the shortest time after being laid down, and without any subsequent period of deterioration, the heaviest crops of grass during the whole of each growing season, and in all kinds of weather; species of early and late growth, and those of a moisture-loving and drought-resisting character, being all represented in well-balanced proportions. This Selection is recommended as the best that can be used for all good medium soils. It does not contain any Perennial Rye-Grass.

SELECTION A.—Medium Soil.	Quantity of seed per acre.	Guar- anteed ger- mination.	Number of ger- minating seeds per statute acre.	Percentage of ground covered by each species	Price of seeds per acre.
	lbs.	per cent.			s. d.
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail</i>).....	4	85	1,666,000	12	5 4
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	7	90	2,683,800	16	8 2
<i>Festuca duriuscula</i> (<i>Hard Fescue</i>)	1	94	543,320	3	1 0
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	4	94	924,960	8	6 0
<i>Festuca pratensis</i> (<i>Meadow Fescue</i>)	6	98	1,387,680	10	9 0
<i>Lolium italicum</i> (<i>Italian Rye-Grass</i>).....	3	90	729,000	5	1 1½
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	1½	96	3,218,400	8	2 0
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>).....	4	98	5,174,400	14	1 10
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1 0
<i>Trifol. prat. perenne</i> (<i>Perennial Red Clover</i>)	1½	98	320,460	4	1 9
<i>Tri. prat. per. var.</i> (<i>Late-flowering Red Clover</i>)	1½	98	320,460	4	2 0
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>)...	2	98	1,434,720	9	2 4
<i>Achillea Millefolium</i> (<i>Yarrow, or Milfoil</i>)...	¼	95	833,625	3	1 9
	36¾	...	19,940,465	100	43 3½

Price per acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards.....	40s. 3d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	41s. 3d.	
	For 20 to 49 Acres	42s. 3d.	
	For less than 20 Acres	43s. 3d.	

All the seeds comprising the above Selection are of the **FINEST QUALITY**, and are **GUARANTEED PURE, GENUINE**, and of the **PERCENTAGES** of GERMINATION stated above.

Each kind of seed is supplied separately, unless a request be made that the seeds be sent mixed ready for sowing. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

GRASSES and CLOVERS (including Perennial Rye-Grass) for PERMANENT PASTURE or MEADOW on Medium Soils.

(SELECTION B.—Medium Soil.)

This is cheaper than Selection A, the use of Perennial Rye-grass and of smaller quantities of some of the more expensive seeds reducing the price per acre.

SELECTION B.—MEDIUM SOIL.	Quantity of seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Percentage of ground covered by each species.	Price of seeds per acre.	
	lbs.	per cent.			s.	d.
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail</i>) ...	3	85	1,249,500	10	4	0
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	7	90	2,683,800	16	8	2
<i>Festuca duriuscula</i> (<i>Hard Fescue</i>)	1	94	543,320	3	1	0
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	4	94	924,960	7½	6	0
<i>Festuca pratensis</i> (<i>Meadow Fescue</i>)	4	98	925,120	7½	6	0
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	3	90	729,000	5	1	1½
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	5	97	1,081,550	10	1	6¾
<i>Poa trivialis</i> (<i>Rough stalked Meadow Grass</i>) ..	1	96	2,145,600	6	1	4
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>)	4	98	5,174,400	14	1	10
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1	0
<i>Trifol. prat. perenne</i> (<i>Perennial Red Clover</i>) ..	1	98	213,640	2½	1	2
<i>Trifol. prat. per. var.</i> (<i>Late-flowg. Red Clover</i>) ..	1	98	213,640	2½	1	4
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>) ...	2	98	1,434,720	9	2	4
<i>Achillea Millefolium</i> (<i>Yarrow or Milfoil</i>) ...	¼	95	833,625	3	1	9
	37¼	...	18,856,515	100	38	7¼

Price per acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards.....	35s. 0d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres.....	35s. 10d.	
	For 20 to 49 Acres.....	36s. 8d.	
	For less than 20 Acres.....	38s. 7d.	

All the seeds comprising the above Selection are of the **FINEST QUALITY**, and are **GUARANTEED PURE, GENUINE**, and of the **PERCENTAGES of GERMINATION** stated above.

CHEAP SELECTION of GRASSES and CLOVERS for PERMANENT PASTURE or MEADOW on Poor Medium Soils.

(SELECTION C.—Medium Soil.)

This cheap selection consists of the same kinds and quantities of seeds specified above in Selection B, but they are of "Second-grade" quality. These second-grade seeds are all warranted pure and genuine, and the percentage of germination is guaranteed.

Price per acre for Guaranteed Seeds of Fine Quality.	For 100 Acres or upwards	31s. 8d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	32s. 4d.	
	For 20 to 49 Acres	33s. 0d.	
	For less than 20 Acres	33s. 8d.	

Each kind of seed is supplied separately, unless a request be made that the seeds be sent mixed. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

JAMES HUNTER'S SELECTION OF

THE BEST GRASSES AND CLOVERS FOR

Permanent Pasture or Meadow

ON HEAVY OR WET SOILS.

(SELECTION A.—Heavy Soil).

This Selection includes the most nutritive and productive species of Grasses and Clovers suitable for laying down heavy or wet soils of good quality to permanent grass. The quantity of each species is carefully regulated with the object of forming pastures that will yield in the shortest time after being laid down, and without any subsequent period of deterioration, the heaviest crops of grass during the whole of each growing season, and in all kinds of weather. Early and late-growing species are included in suitable proportions so that the productive period may be extended as much as possible. This Selection is recommended as the best, at a reasonable cost, that can be used for all heavy or wet soils of good quality. Perennial Rye-grass is excluded.

SELECTION A.—HEAVY SOIL.	Quantity of seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Percentage of ground covered by each species	Price of seeds per acre.
	lbs.	per cent.			s. d.
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail</i>)	4	85	1,666,000	12	5 4
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	7	90	2,683,800	16	8 2
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	5	94	1,156,200	9	7 6
<i>Festuca pratensis</i> (<i>Meadow Fescue</i>)	6	98	1,387,680	11	9 0
<i>Lolium italicum</i> (<i>Italian Rye-Grass</i>).....	3	90	729,000	5	1 1½
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>).	1½	96	3,218,400	8	2 0
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>) ...	4	98	5,174,400	15	1 10
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1 0
<i>Trifol. prat. perenne</i> (<i>Perennial Red Clover</i>).	1½	98	320,460	4	1 9
<i>Trifol. prat. per. var.</i> (<i>Late-flowering Red Clover</i>)	1½	98	320,460	4	2 0
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>) .	2	98	1,434,720	9	2 4
<i>Achillea Millefolium</i> (<i>Yarrow, or Milfoil</i>)...	¼	95	833,625	3	1 9
	36½	...	19,628,385	100	43 9½

Price per Acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards ...	40s. 9d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	41s. 9d.	
	For 20 to 49 Acres	42s. 9d.	
	For less than 20 Acres	43s. 9d.	

All the Seeds comprising the above Selection are of the FINEST QUALITY, and are GUARANTEED PURE, GENUINE, and of the PERCENTAGES OF GERMINATION stated above.

Each kind of seed is supplied separately, unless a request is made that the seeds be sent mixed ready for sowing. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

GRASSES & CLOVERS (including Perennial Rye-Grass) for Permanent Pasture or Meadow ON HEAVY OR WET SOILS.

(SELECTION B.—Heavy Soil).

This is cheaper than Selection A, the use of Perennial Rye-grass and of smaller quantities of some of the more expensive seeds reducing the price per acre.

SELECTION B.—HEAVY SOIL.	Quantity of seed per acre.	Guaran- teed ger- mination.	Number of ger- minating seeds per statute acre.	Percentage of ground covered by each species	Price of seeds per acre.
	lbs.	per cent.			s. d.
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail</i>).....	3	85	1,249,500	9	4 0
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	7	90	2,683,800	16	8 2
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	4	94	924,960	7½	6 0
<i>Festuca pratensis</i> (<i>Meadow Fescue</i>).....	5	98	1,156,400	9½	7 6
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	3	90	729,000	5	1 1½
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	5	97	1,081,550	10	1 6¾
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	1	96	2,145,600	5	1 4
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>).....	5	98	6,468,000	17	2 3½
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1 0
<i>Trifol. prat. perenne</i> (<i>Perennial Red Clover</i>)	1	98	213,640	2½	1 2
<i>Trifol. prat. per. var.</i> (<i>Late-flowg. Red Clover</i>)	1	98	213,640	2½	1 4
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>)..	2	98	1,434,720	9	2 4
<i>Achillea Millefolium</i> (<i>Yarrow or Milfoil</i>)...	¼	95	833,625	3	1 9
	38¼	...	19,838,075	100	39 6¾

Price per Acre for Guaranteed Seeds of Finest Quality.	For 100 Acres or upwards ...	37s. 0d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	37s. 10d.	
	For 20 to 49 Acres	38s. 8d.	
	For less than 20 Acres	39s. 6d.	

All the seeds comprising the above Selection are of the FINEST QUALITY, and are GUARANTEED PURE, GENUINE, and of the PERCENTAGES of GERMINATION stated.

CHEAP SELECTION of GRASSES and CLOVERS for Permanent Pasture or Meadow ON POOR HEAVY SOILS.

(SELECTION C.—Heavy Soil).

This cheap selection consists of the same kinds and quantities of seeds specified above in Selection B, but they are of "second-grade" quality. All these seeds are warranted PURE and GENUINE, and the PERCENTAGE of GERMINATION is GUARANTEED.

Price per Acre for Guaranteed Seeds of Fine Quality.	For 100 Acres or upwards ...	32s. 6d.	Carriage Paid. Five per cent. discount for cash in 14 days.
	For 50 to 99 Acres	33s. 2d.	
	For 20 to 49 Acres	33s. 10d.	
	For less than 20 Acres	34s. 6d.	

Each kind of seed is supplied separately, unless a request is made that the seeds be sent mixed. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

JAMES HUNTER'S SELECTION OF THE BEST GRASSES AND CLOVERS FOR Permanent Pasture or Meadow ON LIGHT DRY SOILS.

(SELECTION A.—Light Soil.)

This selection includes the most nutritive and productive species of grasses and clovers suitable for laying down good light dry soils to permanent grass. On these soils shallow-rooting grasses soon cease to grow in dry weather, but the species in this selection are chosen for their deep-rooting and drought-resisting qualities. This selection is recommended as the best, at a reasonable cost, that can be used for light soils of good quality. For poor dry soils Chicory and Burnet are valuable additions.

The attention of those who own or farm poor unprofitable soils is directed to Mr. R. H. Elliot's method of laying down such land. See pages 20 and 64.

SELECTION A.—LIGHT SOIL.	Quantity of seed per acre.	Guaranteed germination.	Number of germinating seeds per statute acre.	Percentage of ground covered by each species.	Price of seeds per acre.
	lbs.	per cent.			s. d.
<i>Avena elatior</i> (<i>Tall Oat-like Grass</i>)	4	90	496,800	9	4 8
<i>Avena flavescens</i> (<i>Golden Oat Grass</i>).....	$\frac{1}{2}$	80	560,000	3	1 7 $\frac{1}{2}$
<i>Cynosurus cristatus</i> (<i>Crested Dogtail</i>)	$\frac{1}{2}$	94	416,420	2	0 10
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	10	90	3,834,000	24	11 8
<i>Festuca duriuscula</i> (<i>Hard Fescue</i>)	1	94	543,320	2 $\frac{1}{2}$	1 0
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	6	94	1,387,440	12	9 0
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	3	90	729,000	5	1 1 $\frac{1}{2}$
<i>Poa pratensis</i> (<i>Smooth-stalked Meadow Grass</i>)	1	85	1,581,000	5	1 2
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	1	96	2,145,600	5	1 4
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>).....	2	98	2,587,200	7	0 11
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1 0
<i>Tri. prat. per. var.</i> (<i>Late-flowering Red Clover</i>)	2 $\frac{1}{2}$	98	534,100	5	3 4
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>)...	1 $\frac{1}{2}$	98	1,076,040	7	1 9
<i>Anthyllis vulneraria</i> (<i>Kidney Vetch</i>)	2	98	378,280	4	2 0
<i>Medicago sativa</i> (<i>Lucerne</i>)	1	98	219,520	2 $\frac{1}{2}$	1 2
<i>Achillea Millefolium</i> (<i>Yarrow, or Milfoil</i>)...	$\frac{1}{4}$	95	833,625	3	1 9
	37 $\frac{1}{4}$	...	18,025,985	100	44 4

Price per Acre for Guaranteed Seeds of Finest Quality.	{	For 100 Acres or upwards ...41s. 4d.	{	Carriage Paid.
		For 50 to 99 Acres .....42s. 4d.		Five per cent. discount for cash in 14 days.
		For 20 to 49 Acres .....43s. 4d.		
		For less than 20 Acres .....44s. 4d.		

All the Seeds comprising the above Selection are of the **FINEST QUALITY**, and are **GUARANTEED PURE, GENUINE**, and of the **PERCENTAGES OF GERMINATION** stated above.

Each kind of seed is supplied separately, unless a request is made that the seeds be sent mixed ready for sowing. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

GRASSES & CLOVERS (including Perennial Rye-Grass) for Permanent Pasture or Meadow ON LIGHT DRY SOILS. (SELECTION B.—Light Soil.)

SELECTION B.—LIGHT SOIL.	Quantity of seed per acre.	Guaran- teed ger- mination.	Number of ger- minating seeds per statute acre.	Percentage of ground covered by each species.	Price of seeds per acre.
	lbs.	per cent.			s. d.
<i>Avena elatior</i> (<i>Tall Oat-like Grass</i>)	3	90	372,600	7	3 6
<i>Avena flavescens</i> (<i>Golden Oat Grass</i>)	$\frac{1}{4}$	80	280,000	$1\frac{1}{2}$	0 9 $\frac{3}{4}$
<i>Cynosurus cristatus</i> (<i>Crested Dogtail</i>)	$\frac{1}{4}$	94	208,210	1	0 5
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>)	9	90	3,450,600	22	10 6
<i>Festuca duriuscula</i> (<i>Hard Fescue</i>)	1	94	543,320	$2\frac{1}{2}$	1 0
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	5	94	1,156,200	$9\frac{1}{2}$	7 6
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	3	90	729,000	5	1 1 $\frac{1}{2}$
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	5	97	1,081,550	9	1 6 $\frac{3}{4}$
<i>Poa pratensis</i> (<i>Smooth-stalked Meadow Grass</i>)	1	85	1,581,000	5	1 2
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	1	96	2,145,600	5	1 4
<i>Phleum pratense</i> (<i>Catstail, or Timothy</i>)	2	98	2,587,200	7	0 11
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	1	98	703,640	4	1 0
<i>Trifol. prat. per. var.</i> (<i>Late-flowg. Red Clover</i>)	2	98	427,280	5	2 8
<i>Trifolium repens</i> (<i>White, or Dutch Clover</i>)	$1\frac{1}{2}$	98	1,076,040	7	1 9
<i>Anthyllis vulneraria</i> (<i>Kidney Vetch</i>)	2	98	378,280	4	2 0
<i>Medicago sativa</i> (<i>Lucerne</i>)	1	98	219,520	$2\frac{1}{2}$	1 2
<i>Achillea Millefolium</i> (<i>Yarrow, or Milfoil</i>) ..	$\frac{1}{4}$	95	833,625	3	1 9
	38 $\frac{1}{4}$	...	17,773,665	100	40 2

Price per Acre for Guaranteed Seeds of Finest Quality.	{ For 100 Acres or upwards ... 37s. 8d. { For 50 to 99 Acres 38s. 6d. { For 20 to 49 Acres 39s. 4d. { For less than 20 Acres 40s. 2d.	Carriage Paid. Five per cent. discount for cash in 14 days.
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All the Seeds comprising the above Selection are of the FINEST QUALITY, and are GUARANTEED PURE, GENUINE, and of the PERCENTAGES of GERMINATION stated.

CHEAP SELECTION of GRASSES and CLOVERS for Permanent Pasture or Meadow ON POOR, LIGHT DRY SOILS. (SELECTION C.—Light Soil.)

This cheap Selection consists of the same kinds and quantities of seeds specified above in Selection B, but they are of "Second-grade" quality. These second-grade seeds are all warranted pure and genuine, and the Percentage of Germination is Guaranteed.

Price per Acre for Guaranteed Seeds of Fine Quality.	{ For 100 Acres or upwards ... 33s. 0d. { For 50 to 99 Acres 33s. 8d. { For 20 to 49 Acres 34s. 3d. { For less than 20 Acres 34s. 11d.	Carriage Paid. Five per cent. discount for cash in 14 days.
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Each kind of seed is supplied separately, unless a request is made that the seeds be sent mixed. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

JAMES HUNTER'S SELECTIONS.

THE BEST GRASSES AND CLOVERS FOR ONE YEAR (for Mowing).

NAME OF SEED.	Guaranteed germination. per cent.	Light Soils.		Medium & Heavy Soils.	
		lbs.	s. d.	lbs.	s. d.
Italian Rye-grass	90	8	3 0	9	3 4 $\frac{1}{2}$
Cocksfoot Grass	90	3	3 6	3	3 6
Catstail, or Timothy Grass	98	2	0 11	3	1 4 $\frac{1}{2}$
Red, or Broad Clover	98	4	4 0	4	4 0
Alsike Clover	98	1	1 0	1	1 0
Trefoil, or Yellow Clover	98	1	0 10	—	—
Kidney Vetch	98	2	2 0	1	1 0
REDUCED PRICES FOR LARGE QUANTITIES.		21	15 3	21	14 3
Finest Quality Guaranteed Seeds:—					
Price per Acre, for 100 acres or upwards		14s.	3d.	13s.	3d.
Price per Acre, for 50 to 99 acres		14s.	7d.	13s.	7d.
Price per Acre, for 25 to 49 acres		14s.	11d.	13s.	11d.
Price per Acre, for less than 25 acres		15s.	3d.	14s.	3d.

If for grazing, substitute 1lb. White Clover for a similar weight of Red Clover in the above Tables.

THE BEST GRASSES AND CLOVERS FOR TWO YEARS (for Mowing or Grazing).

NAME OF SEED.	Guaranteed germination. per cent.	Light Soils.		Medium & Heavy Soils.	
		lbs.	s. d.	lbs.	s. d.
Italian Rye-grass	90	4	1 6	4	1 6
Perennial Rye-grass	97	4	1 3	4	1 3
Cocksfoot Grass	90	4	4 8	4	4 8
Meadow Fescue Grass	98	3	4 6	3	4 6
Catstail, or Timothy Grass	98	2	0 11	3	1 4 $\frac{1}{2}$
Red, or Broad Clover	98	3	3 0	3	3 0
White, or Dutch Clover	98	1	1 2	1	1 2
Alsike Clover	98	1	1 0	1	1 0
Kidney Vetch	98	2	2 0	1	1 0
REDUCED PRICES FOR LARGE QUANTITIES.		24	20 0	24	19 5 $\frac{1}{2}$
Finest Quality Guaranteed Seeds:—					
Price per Acre, for 100 acres or upwards		18s.	9d.	18s.	2d.
Price per Acre, for 50 to 99 acres		19s.	2d.	18s.	7d.
Price per Acre, for 25 to 49 acres		19s.	7d.	19s.	0d.
Price per Acre, for less than 25 acres		20s.	0d.	19s.	5d.

Each kind of seed is supplied separately, unless a request is made that the seeds be sent mixed. Small orders of 2 acres or less are sent mixed unless otherwise ordered.

THE BEST GRASSES AND CLOVERS

FOR THREE YEARS (for Mowing or Grazing).

NAME OF SEED.	Guaranteed germination. Per cent.	Light Soils.		Medium & Heavy Soils.	
		lbs.	s. d.	lbs.	s. d.
Italian Rye-grass	90	4	1 6	4	1 6
Perennial Rye-grass	97	6	1 10½	6	1 10½
Cocksfoot Grass.....	90	6	7 0	5	5 10
Meadow Fescue Grass	98	3	4 6	4	6 0
Tall Fescue Grass	94	3	4 6	3	4 6
Cattail, or Timothy Grass	98	2	0 11	3	1 4½
Perennial Red Clover.....	98	1½	1 9	1½	1 9
Late-flowering Red Clover	98	1½	2 0	1½	2 0
White, or Dutch Clover.....	98	1	1 2	1	1 2
Alsike Clover	98	1	1 0	1	1 0
Kidney Vetch.....	98	1	1 0	—	—
REDUCED PRICES FOR LARGE QUANTITIES.		30	27 2½	30	27 0
Finest Quality Guaranteed Seeds:—					
Price per Acre, for 100 acres or upwards		25s.	8d.	25s.	6d.
Price per Acre, for 50 to 99 acres		26s.	2d.	26s.	0d.
Price per Acre, for 25 to 49 acres		26s.	8d.	26s.	6d.
Price per Acre, for less than 25 acres		27s.	2d.	27s.	0d.

THE BEST GRASSES AND CLOVERS

FOR FOUR YEARS or longer or for TEMPORARY PASTURE.

NAME OF SEED.	Guaranteed germination. Per cent.	Light Soils.		Medium & Heavy Soils.	
		lbs.	s. d.	lbs.	s. d.
Italian Rye-grass	90	4	1 6	4	1 6
Perennial Rye-grass	97	5	1 6¾	5	1 6¾
Cocksfoot Grass.....	90	8	9 4	7	8 2
Meadow Fescue Grass	98	3	4 6	4	6 0
Tall Fescue Grass	94	3	4 6	3	4 6
Rough-stalked Meadow Grass	96	½	0 8	1	1 4
Cattail, or Timothy Grass	98	2	0 11	3	1 4½
Perennial Red Clover	98	1½	1 9	1½	1 9
Late-flowering Red Clover	98	1½	2 0	1½	2 0
White, or Dutch Clover	98	1	1 2	1	1 2
Alsike Clover	98	1	1 0	1	1 0
Kidney Vetch	98	1½	1 6	—	—
REDUCED PRICES FOR LARGE QUANTITIES.		32	30 4¾	32	30 4½
Finest Quality Guaranteed Seeds:—					
Price per Acre, for 100 acres or upwards.....		28s.	4d.	28s.	4d.
Price per Acre, for 50 to 99 acres		29s.	0d.	29s.	0d.
Price per Acre, for 25 to 49 acres		29s.	8d.	29s.	8d.
Price per Acre, for less than 25 acres.....		30s.	4d.	30s.	4d.

LIST OF ILLUSTRATIONS OF THE SEEDS OF GRASSES, CLOVERS, FORAGE PLANTS AND WEEDS.

On the following pages are shown micro-photographs of the Seeds of the various Grasses, Clovers, and other plants used in laying down land to grass, &c.; also a collection of the Weed Seeds often found in Grass and Clover Seeds. These illustrations will enable the reader to identify the different species of seeds, to form a judgment of the genuineness of a sample, and to detect any impurities it may contain.

When comparing samples of seeds with these illustrations, or one illustration with another, the different magnifications should be noted. The magnifications are stated at the bottom of each page of the illustrations. It is necessary to bear in mind that if a seed is stated to be magnified 8 diameters, it is 64 times (not 8 times) larger than the actual seed; the seed varies as the square of the diameter.

GRASS SEEDS.

	FIG. NO.		FIG. NO.
<i>Aira cæspitosa</i> (Tufted Hair-Grass)	18	<i>Festuca duriuscula</i> (Hard Fescue-Grass)	10
— <i>flexuosa</i> (Wavy Mountain Hair-Grass)...	2	— <i>elatior</i> (Tall Fescue-Grass) ...	11
<i>Alopecurus agrestis</i> (Black Grass)	5	— <i>ovina tenuifolia</i> (Fine leaved Fescue) ...	19
— <i>pratensis</i> (Meadow Foxtail Grass).....	7	— <i>pratensis</i> (Meadow Fescue-Grass) ...	12
<i>Anthoxanthum odoratum</i> (Sweet Vernal-Grass)	8	— <i>sciuroides</i> (Squirrel tail Fescue Grass)...	14
— <i>Puelii</i> (Puel's Vernal-Grass)	6	<i>Holcus lanatus</i> (Yorkshire Fog)	3
<i>Avena elatior</i> (Tall Oat-like-Grass)	4	<i>Lolium italicum</i> (Italian Ryegrass)	16
— <i>flavescens</i> (Golden Oat-Grass)	1	— <i>perenne</i> (Perennial Ryegrass).....	13
<i>Bromus mollis</i> (Soft Brome-Grass)	17	<i>Phleum pratense</i> (Catstail or Timothy)	21
— <i>secalinus</i> (Rye seeded Brome-Grass) ...	15	<i>Poa annua</i> (Annual Meadow Grass)	24
<i>Cynosurus cristatus</i> (Crested Dogstail-Grass) .	20	— <i>nemorialis</i> (Wood Meadow Grass)	22
<i>Dactylis glomerata</i> (Cocksfoot-Grass)	9	— <i>pratensis</i> (Smooth-stalked Meadow Grass)	25
		— <i>trivialis</i> (Rough stalked Meadow Grass) .	23

CLOVER AND FORAGE PLANT SEEDS.

	FIG. NO.		FIG. NO.
<i>Achillea Millefolium</i> (Yarrow, or Milfoil) ...	27	<i>Sinapis alba</i> (White Mustard)	38
<i>Anthyllis vulneraria</i> (Kidney Vetch)	33	<i>Trifolium hybridum</i> (Alsike Clover)	31
<i>Cichorium intybus</i> (Chicory)	28	— <i>pratense</i> (Red or Broad-leaved Clover) ..	32
<i>Medicago lupulina</i> (Trefoil or Yellow Clover)	35	— — <i>perenne</i> (Perennial Red Clover)... ..	30
— <i>sativa</i> (Lucerne or Alfalfa)	36	— — — <i>var.</i> (Late-flowering Red Clover)	29
<i>Onobrychis sativa</i> (Sainfoin)	39	— <i>repens</i> (White Clover)	34
<i>Polygonum Fagopyrum</i> (Buckwheat)	40	— <i>incarnatum</i> (Crimson Clover).....	37
<i>Petroselinum sativum</i> (Parsley)	41	— <i>minus</i> (Suckling Clover).....	59
<i>Poterium Sanguisorba</i> (Burnet)	26	<i>Ulex Europæus</i> (Gorse or Furze)	42

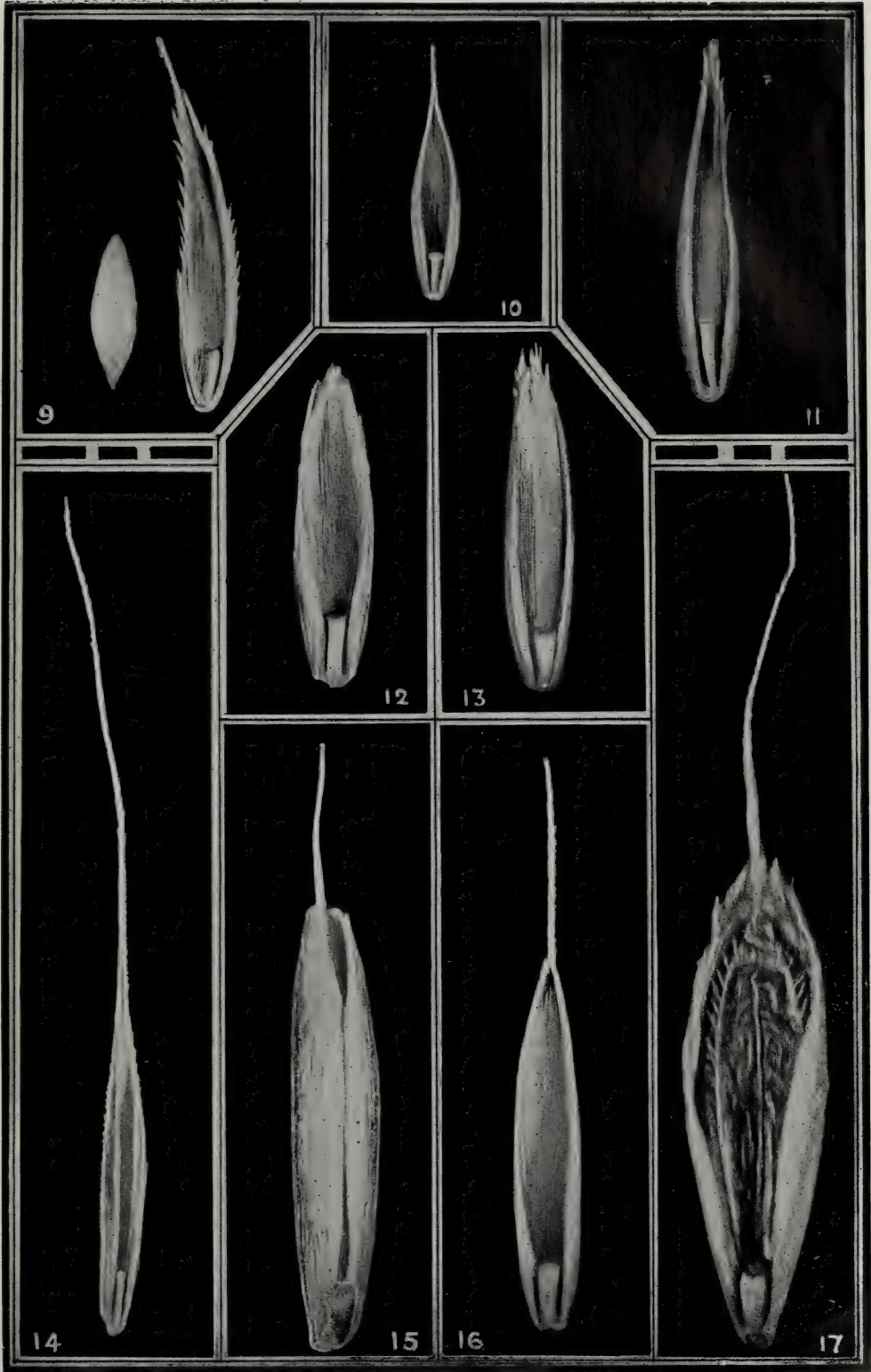
WEED SEEDS.

	FIG. NO.		FIG. NO.
<i>Anthemis arvensis</i> (Field Chamomile)	76	<i>Plantago lanceolata</i> (Ribgrass)	57
<i>Carduus arvensis</i> (Field Thistle)	77	— <i>major</i> (Way-bread)	64
<i>Centaurea nigra</i> (Knapweed)	52	<i>Polygonum aviculare</i> (Knot-grass)	50
<i>Chrysanthemum leucanthemum</i> (Ox-eye Daisy)	61	— <i>Persicaria</i> (Red-shank)	60
<i>Cuscuta epithymum</i> (Lesser Dodder)	68	<i>Prunella vulgaris</i> (Self-heal)	69
— <i>racemosa</i> (American Dodder)	66	<i>Ranunculus acris</i> (Upright Crowfoot)	56
— <i>Trifolii</i> (Clover Dodder)	67	— <i>repens</i> (Creeping Crowfoot)	58
<i>Geranium dissectum</i> (Cut-leaved Geranium) .	53	<i>Rumex acetosella</i> (Sheep's Sorrel).....	72
— <i>molle</i> (Dove's-foot Geranium)	55	— <i>obtusifolius</i> (Dock)	54
<i>Lapsana communis</i> (Nipplewort)	74	<i>Stellaria media</i> (Chickweed)	63
<i>Lychnis diurna</i> (Red Campion)	65	<i>Sherardia arvensis</i> (Field Madder)	51
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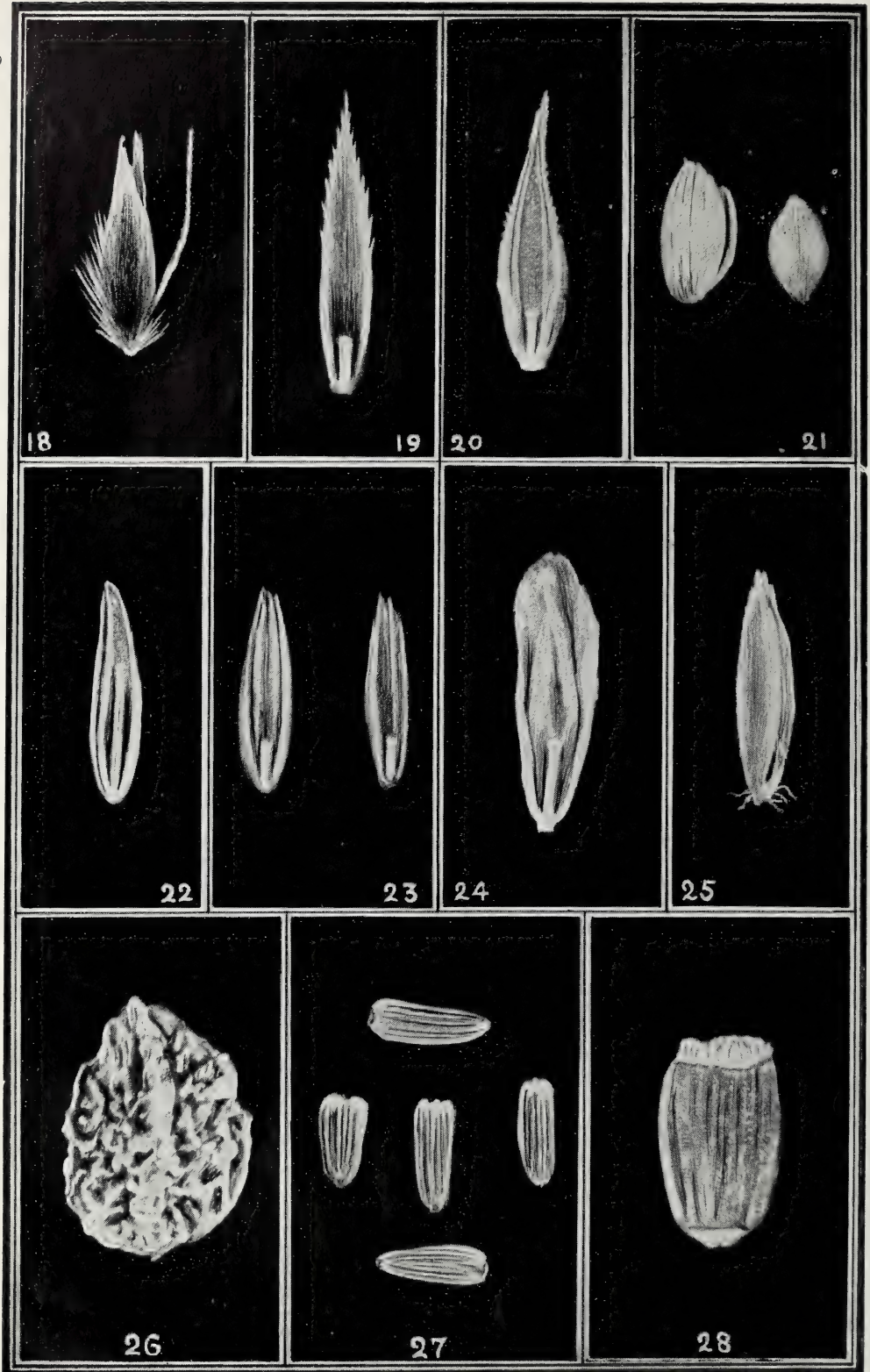
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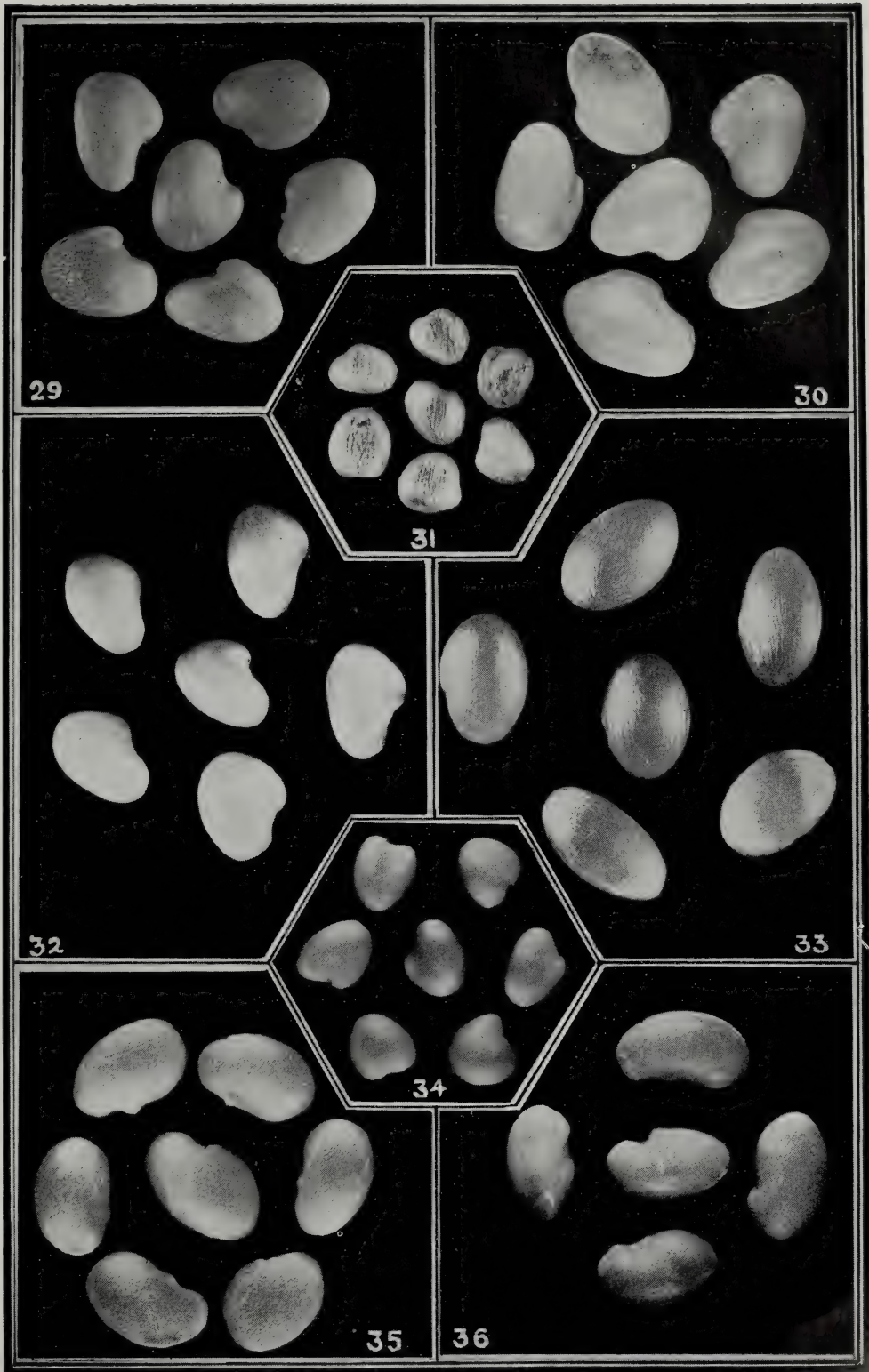
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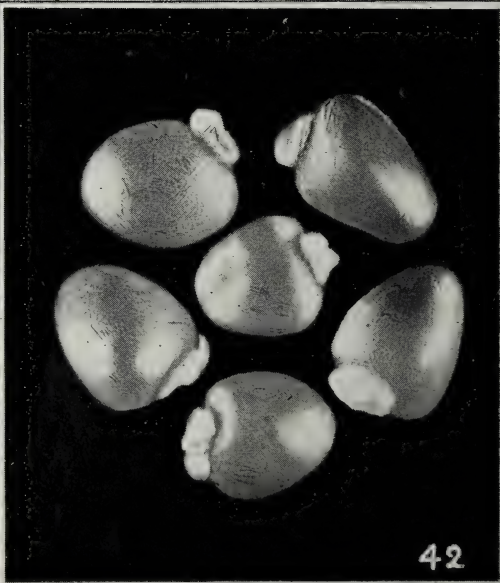
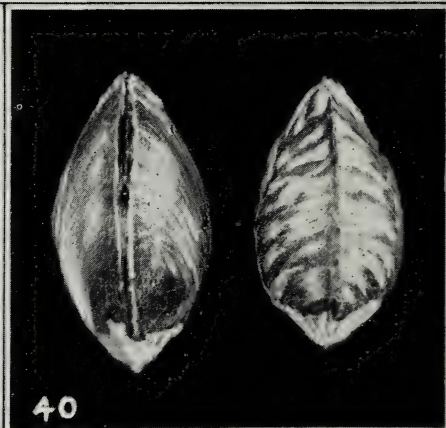
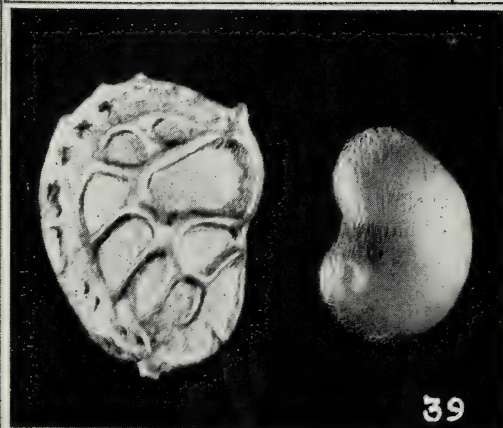
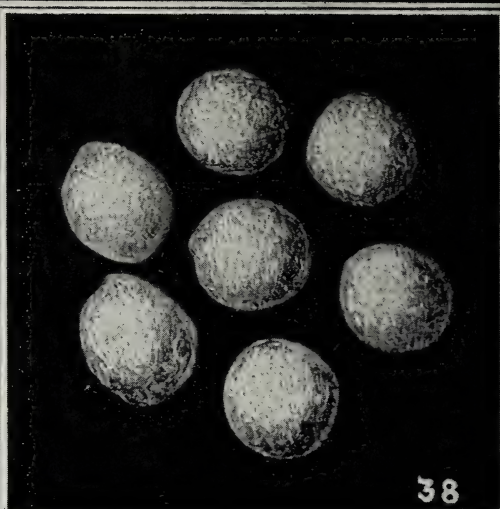
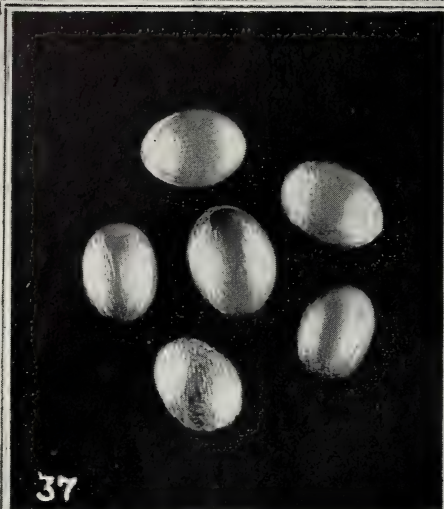
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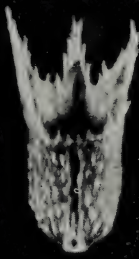
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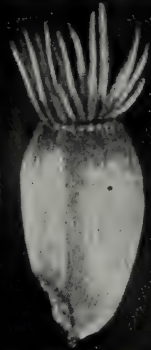




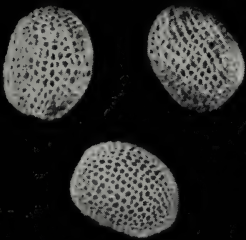
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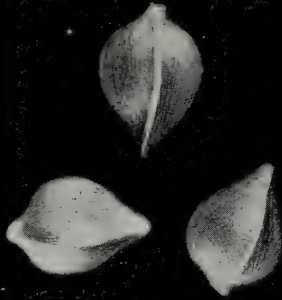
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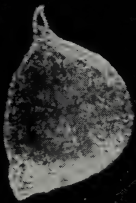
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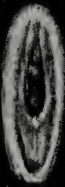
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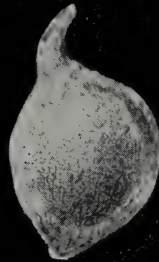
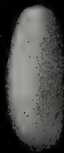
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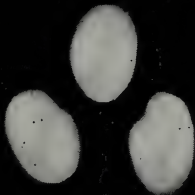
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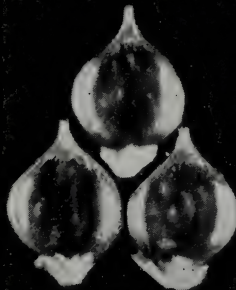
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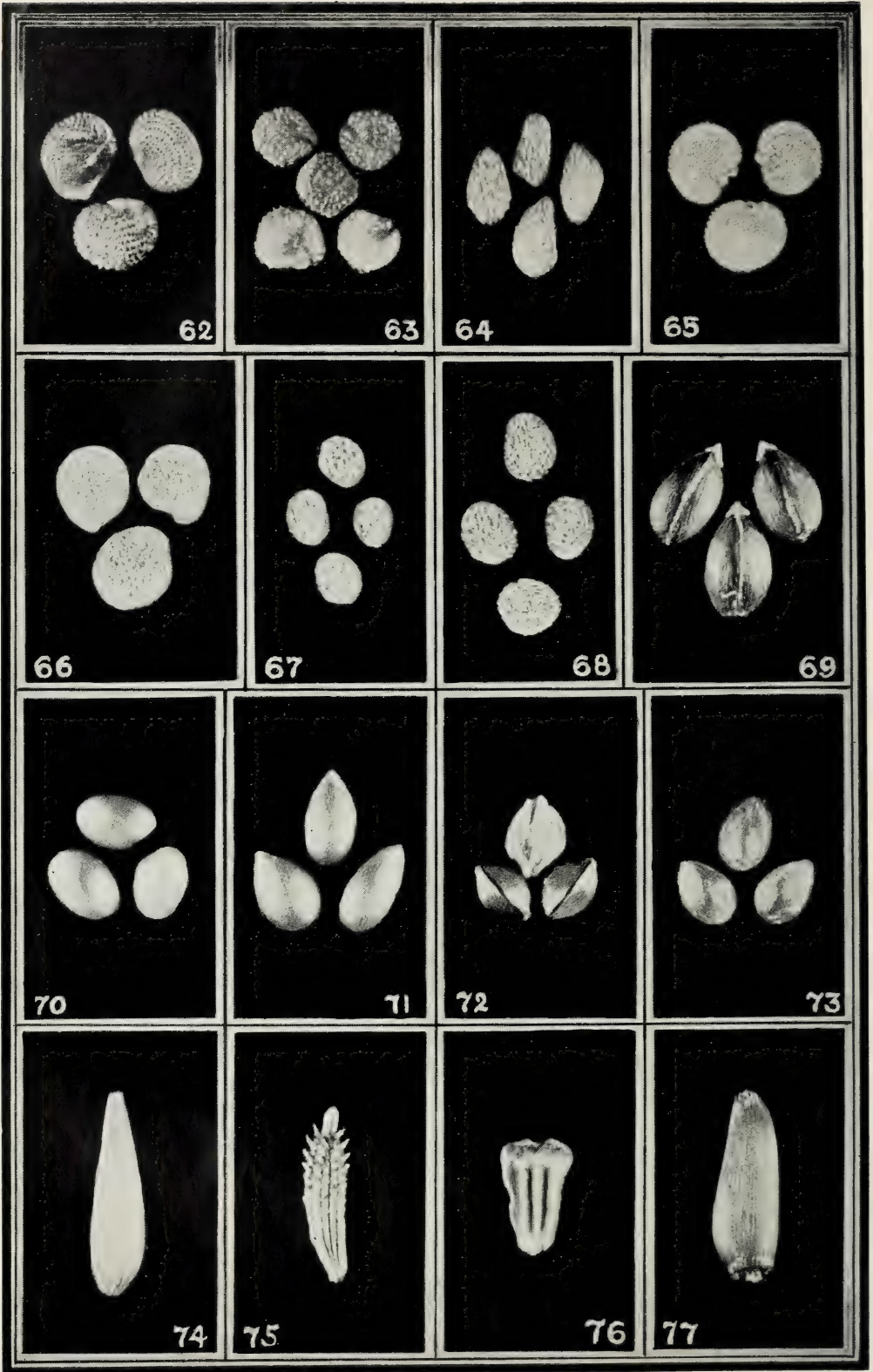
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Permanent Pasture Grasses

— and —

The Adulteration of their Seeds.

Grass seeds of the various kinds commonly used for laying down to grass, greatly differ from each other in their appearance, size, weight, &c., and the quality of the seeds usually offered for sale varies to an extent far beyond what would be imagined. The necessity, therefore, for a Standard of Quality, by which the ordinary user of these seeds may, with a fair degree of certainty, judge the quality of the seeds he buys, is obvious. On page 43, such a Standard, applicable to the seeds of all the grasses, clovers, and other plants used in laying down land to grass, either for long or for short periods, is given.

In the first column of figures in the table will be found the percentage of germination that seed of any given species, of the highest quality, harvested in good condition in an average year, should possess. This Standard, it will be understood, is a high one ; but it can be attained without real difficulty, and users of seeds should not be content with anything inferior. It should never be forgotten that seed of the highest germination is always the cheapest, and that the highest germinating seed is also almost certain to be the purest, so that true economy can only be attained by using the very best seeds. It must be obvious that the higher the percentage of germination of any seed, the greater its money value. One pound of seed germinating 90 per cent. will produce as many plants as, and of more vigorous growth than, $1\frac{1}{2}$ lbs. of seed whose germination is only 60 per cent., so that if the value of the former is 1s. 6d. per lb., the latter is dear at 1s. per lb. Such being the case, it is astonishing that many who use grass seeds do not think it necessary to take precautions to ensure that the seeds they buy shall be of good germination, although it is a matter of such importance to themselves, not only as regards the future success of the pasture, which is the chief consideration, but also because of the present pecuniary advantage. If users of Grass Seeds studied their own interests, they would buy none without an exact statement of the germinating power of each kind. All vague statements as to the seeds being of "proved germination," &c., are valueless ; and, unless the exact percentage of germination is stated, it cannot be known by the purchaser whether the seeds are of proved *good* germination or proved *bad* germination.

The next point of importance in regard to the quality of any grass seed is the weight per bushel of the sample, *vide* second column of figures in the table. Than this there is no better evidence of quality, and provided the seed is new and free from admixture with seed of another species, the test of weight alone will affirm the good quality of any sample of grass seed. The variation in the weight per bushel of the seed of any single species of grass is very great, as the following instances will show : Meadow Foxtail may weigh from 5 lbs. to 14 lbs. per bushel ; Cocksfoot from 6 lbs. to 24 lbs. ; Meadow Fescue from 10 lbs. to 30 lbs. ; Perennial Rye-grass from 14 lbs. to 30 lbs. ; and all the others in similar degree. The explanation of this is simple. The heaviest samples must consist entirely of heavy ripe seeds, free from all chaff and undeveloped non-germinating seeds, and provided such

a sample of seed is new and sound, it cannot fail to be of the highest germination—say, 90 to 98 per cent. Seed of lighter weight per bushel is composed partly of heavy ripe seeds, partly of undeveloped seeds and chaff, and, in consequence, the germinating capability of the sample must be comparatively low. The lightest samples may be composed entirely of undeveloped seeds and chaff, having a possible germinating capability of not more than 5 per cent. It must follow that the use of such low class seeds can only result in failure, disappointment, and serious loss.

The number of germinating seeds in one pound has an important bearing on the choice of seeds for a grass mixture, as, owing to the great difference in the size of the seeds of the different species, it is impossible without this knowledge to allot the due proportion of each species in the mixture. The table on page 43 shows that while 1 lb. of one species may contain over 3,000,000 seeds, 1 lb. of another species may have not more than 80,000.

In the fifth column of figures in the table is given the price per million germinating seeds, of the finest quality, for the current year. As variations in prices occur every year it is, of course, necessary to ascertain the prices of seeds at the time they are required.

To produce a good seed mixture at the least cost, the fifth column of figures in the table should be studied. This column shows that the cost of 1,000,000 germinating seeds of Timothy grass is 4d., while 1,000,000 germinating seeds of Tall Oat grass is 9s. 4d., although the current price per lb. of these seeds is respectively 5½d. and 1s. 2d. It is obvious, therefore, that the price per lb. of the seed does not convey a clear idea of its real cost, but that the cost per million germinating seeds does. The natural deduction from a study of the cost per million seeds is, that taking all the circumstances of soil, situation, and climate, the duration of the pasture and the requirements of the farmer, into consideration, the freest use of the cheapest seeds suitable to the requirements, should be made. It should not be forgotten that the price of a seed is not arrived at because of its value to the sower: its market value depends on the cost of its production, and the demand for it in relation to the supply. It follows, therefore, that a seed that is easily produced is cheap, and one that is not is dear; also, a small-seeded species, having many seeds to the pound, is cheap, while a large-seeded kind must be dear.

When seeds have been harvested under unfavourable conditions, or when there is a partial failure of crop of any species, the standard of germination for that species may be somewhat lower, and the price of the seed higher, so that due allowance must be made for such causes when they arise. It should also be borne in mind that the figures in the Table apply only to seeds of the highest standard of quality. Seeds of lower quality have a lower germination, are lighter in weight per bushel, have a greater number of seeds in 1 lb. weight, and, although cheaper by the lb., the cost per million germinating seeds is usually greater than that of the best seeds.

The illustrations of the seeds used for laying down land to grass (*vide* pages 33 to 40) will enable any one, who is willing to give some attention to the subject, to judge of the genuineness and purity of a sample of grass seed. These illustrations have been carefully prepared from photo-micrographs of the different species. It must be evident, even to one who is not an expert, that any seed or other matter contained in any sample under examination which differs in shape, appearance, or character from the true seed, must be an impurity, and in order to ascertain the amount of pure seed and of the impurities, a separation of a given quantity should be made and the result noted.

STANDARD OF QUALITY OF SEEDS FOR GRASS MIXTURES.

NAME OF SPECIES.	Percentage of germination.	Weight per bushel.	Number of seeds in one pound.	Number of germinating seeds in one pound.	Cost of 1,000,000 germinating seeds in 1910.
		lbs.			s. d.
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail</i>).....	85	14	490,000	416,500	3 8
<i>Anthoxanthum odoratum</i> (<i>Sweet Vernal</i>)...	80	16	738,000	590,400	5 6
<i>Avena elatior</i> (<i>Tall Oat-like Grass</i>)	90	16	138,000	124,200	9 4
<i>Avena flavescens</i> (<i>Golden Oat Grass</i>)	80	14	1,400,000	1,120,000	2 11
<i>Cynosurus cristatus</i> (<i>Crested Dogtail</i>)	94	38	886,000	832,840	2 0
<i>Dactylis glomerata</i> (<i>Cocksfoot</i>).....	90	22	426,000	383,400	3 0
<i>Festuca duriuscula</i> (<i>Hard Fescue</i>)	94	30	578,000	543,320	1 10
<i>Festuca elatior</i> (<i>Tall Fescue</i>)	94	26	246,000	231,240	6 6
<i>Festuca ovina tenuifolia</i> (<i>Fine-leaved Fescue</i>)	90	30	1,561,000	1,404,900	1 8
<i>Festuca pratensis</i> (<i>Meadow Fescue</i>).....	98	30	236,000	231,280	6 6
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	90	23	270,000	243,000	1 6
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	97	28	223,000	216,310	1 5
<i>Phleum pratense</i> (<i>Catstail or Timothy</i>)	98	50	1,320,000	1,293,600	0 4
<i>Poa nemoralis</i> (<i>Wood Meadow Grass</i>)	85	26	2,325,000	1,976,250	1 5
<i>Poa pratensis</i> (<i>Smooth-stalked Meadow Grass</i>)	85	28	1,860,000	1,581,000	0 9
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	96	30	2,235,000	2,145,600	0 7½
<i>Achillea Millefolium</i> (<i>Yarrow or Milfoil</i>) ...	95	38	3,510,000	3,334,500	2 0¾
<i>Anthyllis vulneraria</i> (<i>Kidney Vetch</i>)	98	64	193,000	189,140	5 4
<i>Cichorium intybus</i> (<i>Chicory</i>)	80	35	335,000	268,000	3 1
<i>Lotus corniculatus</i> (<i>Birdsfoot Trefoil</i>).....	95	65	412,000	391,400	4 6
<i>Medicago lupulina</i> (<i>Trefoil or Yellow Clover</i>)	98	68	319,000	312,620	2 8
<i>Medicago sativa</i> (<i>Lucerne</i>)	98	65	224,000	219,520	5 3
<i>Petroselinum sativum</i> (<i>Parsley</i>)	90	45	230,000	207,000	2 5
<i>Poterium Sanguisorba</i> (<i>Burnet</i>)	150	27	54,000	81,000	8 3
<i>Trifolium hybridum</i> (<i>Alsike Clover</i>)	98	66	718,000	703,640	1 5
<i>Trifolium incarnatum</i> (<i>Italian or Crim. Clover</i>)	98	66	118,000	115,640	3 3
<i>Trifolium pratense</i> (<i>Red or Broad Clover</i>)...	98	66	232,000	227,360	4 3
<i>Trifolium pratense perenne</i> (<i>Perl. Red Clover</i>)	98	66	218,000	213,640	5 4
<i>Trifolium prat. per. var.</i> (<i>Late-fl. Red Clover</i>)	98	66	218,000	213,640	6 0
<i>Trifolium repens</i> (<i>White or Dutch Clover</i>)...	98	68	732,000	717,360	1 8

The figures in the above table vary from year to year, according to the more or less favourable character of the season during which the seeds have been harvested. Those now set down apply to the seeds available for use in 1910. Particular attention is directed to the fact that the above results, which have just been carefully verified, are obtained from thoroughly-cleaned seeds of the *highest quality, and of heaviest weight per bushel*. Seeds of lower quality and lighter weight would give a much greater number of seeds in 1lb., but in this case the percentage of germination and also the number of germinating seeds in 1lb., would be much less.

Estimate of the relative productiveness (quantity of grass produced in one season) of various species of Grasses, when grown on soils and under conditions best suited to the different species, arranged in the order of their productiveness :—

	Estimated percentage of productiveness.
<i>Dactylis glomerata</i> (<i>Cocksfoot Grass</i>)	100
<i>Festuca elatior</i> (<i>Tall Fescue Grass</i>)	100
<i>Avena elatior</i> (<i>Tall Oat Grass</i>)	100
<i>Phleum pratense</i> (<i>Timothy Grass</i>)	75
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	75
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	70
<i>Festuca pratensis</i> (<i>Meadow Fescue Grass</i>)	70
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail Grass</i>)	70
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	60
<i>Avena flavescens</i> (<i>Golden Oat Grass</i>)	55
<i>Poa pratensis</i> (<i>Smooth-stalked Meadow Grass</i>)	55
<i>Festuca duriuscula</i> (<i>Hard Fescue Grass</i>)	50
<i>Anthoxanthum odoratum</i> (<i>Sweet Vernal Grass</i>)	50
<i>Cynosurus cristatus</i> (<i>Crested Dogstail Grass</i>)	45
<i>Poa nemoralis</i> (<i>Wood Meadow Grass</i>)	45
<i>Festuca ovina tenuifolia</i> (<i>Fine-leaved Fescue Grass</i>)	40

Grasses arranged in the order of their cost for seeds required to sow a statute acre, the prices upon which the calculations are based being those for the year 1910 :—

NAME OF SPECIES.	To sow a statute acre.	Price of seeds per lb.		Cost of seeds per acre.	
	lbs.	s.	d.	s.	d.
<i>Phleum pratense</i> (<i>Timothy Grass</i>)	16	0	5½	7	4
<i>Poa trivialis</i> (<i>Rough-stalked Meadow Grass</i>)	10	1	4	13	4
<i>Lolium perenne</i> (<i>Perennial Rye-grass</i>)	56	0	3¼	17	6
<i>Lolium italicum</i> (<i>Italian Rye-grass</i>)	48	0	4½	18	0
<i>Poa pratensis</i> (<i>Smooth-stalked Meadow Grass</i>)	16	1	2	18	8
<i>Dactylis glomerata</i> (<i>Cocksfoot Grass</i>)	30	1	2	35	0
<i>Festuca duriuscula</i> (<i>Hard Fescue Grass</i>)	36	1	0	36	0
<i>Poa nemoralis</i> (<i>Wood Meadow Grass</i>)	14	2	9	38	6
<i>Alopecurus pratensis</i> (<i>Meadow Foxtail Grass</i>)	32	1	4	42	8
<i>Festuca ovina tenuifolia</i> (<i>Fine-leaved Fescue</i>)	20	2	3	45	0
<i>Cynosurus cristatus</i> (<i>Crested Dogstail Grass</i>)	30	1	8	50	0
<i>Avena flavescens</i> (<i>Golden Oat Grass</i>)	18	3	3	58	6
<i>Avena elatior</i> (<i>Tall Oat Grass</i>)	56	1	2	65	4
<i>Festuca elatior</i> (<i>Tall Fescue Grass</i>)	50	1	6	75	0
<i>Festuca pratensis</i> (<i>Meadow Fescue Grass</i>)	56	1	6	84	0
<i>Anthoxanthum odoratum</i> (<i>Sweet Vernal</i>)	36	3	0	108	0

The above Tables are intended to serve as a guide to the economical use of grass seeds. When making a selection, the following points should each receive due consideration :—

- (1) Productiveness. (2) Suitability of the species for the soil and climate, and for the purpose for which the seeds are required. (3) Cost of the seeds.

Some grasses produce more than double the quantity of herbage yielded by others; and the difference in the cost of their seeds is very great. Some of the more expensive kinds are inferior to some that are far cheaper, as the price of seed depends on the cost of production, and not on its real value.

If the information given is carefully considered it will not be difficult to select grasses that are at once the best and least expensive. Taking, for example, *Phleum pratense* (Timothy), which is the lowest priced seed, it also will be found to rank high as regards productiveness, so that this species readily takes its place as the cheapest grass seed, and therefore worthy of extensive use. On the other hand, *Anthoxanthum odoratum* (Sweet Vernal), which is the most expensive, will be found to be one of the least productive (and at the same time a grass of inferior quality), so that it may be considered as unworthy of notice from an agricultural point of view.

GEOLOGICAL FORMATIONS.

Although much has been said about "geological formations" in connection with laying down land to permanent pasture, this has really a very unimportant bearing upon the subject, and it is more likely to lead to confusion than otherwise. The whole of the species and varieties of Grasses and Clovers that are desirable for permanent pastures are fewer than twenty in number, and four-fifths of that number of species and varieties will thrive, and are actually found growing naturally on all good soils throughout the whole of the United Kingdom. When soils are either very light or very dry, very heavy or very wet, an alteration of the proportions and a variation of a few of the species will be necessary, but to ring the changes upon the twenty Grasses and Clovers just alluded to, through some fifty different geological formations, seems to be little better than a piece of pedantry, and is certainly very misleading. For all practical purposes, it is quite sufficient to know the general character of the soil, whether clayey, loamy, sandy, and whether wet or dry; and as to situation, whether exposed or otherwise.

SELECTIONS OF GRASSES FOR PERMANENT PASTURES.

When choosing suitable Grasses and Clovers to form a permanent pasture, the proportion of plants of each particular species, or the percentage of ground to be covered by each species, ought to be first determined. A glance at the table on page 43 will show that while one pound weight of grass seed of one species may contain about one hundred and twenty thousand germinating seeds, the same weight of that of another species may contain over three millions of germinating seeds, proving the necessity for proportioning the quantity of seed to be used per acre, not by weight, but by the number of germinating seeds.

HOW TO OBTAIN GOOD AND GENUINE SEEDS.

The simplest means of obtaining a supply of good and genuine seeds are these:—

- 1st.—To require from the seed-merchant, when purchasing, a guarantee of the purity (freedom from admixture of other seeds), genuineness (truthfulness to name), and percentage of germination of each species of Grass and Clover seed.
- 2nd.—To require that the seed of each species of Grass and Clover be supplied separately, and on no account whatever to buy "mixtures" of seeds.
- 3rd.—As soon as the seeds are delivered, to take samples from the bulks, to be tested by an experienced botanist, and if found unsatisfactory they should not be used.

ANALYSIS OF GRASS SEEDS.

The adoption of the above method would prevent the sale of adulterated and spurious seeds; but to afford an opportunity for testing the purity and germination of the seeds, they should be purchased a month before the time of sowing. When the seeds have been received, samples should be taken from the bulks, and, in fairness to the seed-merchant, this should be done as carefully as possible. A sample should not be taken from the top of a sack, but the hand should be thrust well down into the seed and a sample then taken. When one kind of seed is contained in several sacks an equal portion should be taken from each sack and mixed together to form a sample for analysis.

TIME OF SOWING PERMANENT GRASS SEEDS.

April and August are the most suitable months in the year for laying down land to permanent grass; but, the weather being favourable, grass seeds may be successfully sown any time from the middle of March to the middle of September, but it should be remembered, that when sown as late as the middle of September, the clovers run a greater risk of injury from early frosts than if sown three weeks earlier, so that it is a distinct

advantage to sow at the earlier period if possible. Grass seeds should not be sown when the weather is hot and dry, as they cannot then germinate, and failure may ensue; nor during windy weather, when they cannot be regularly distributed. It is so obvious as to be scarcely necessary to mention that the finer the tilth of the land to be laid down the better will the seeds germinate, and the thicker will the plants be on the ground. Some grass seeds are so minute and delicate that unless the tilth is fine they cannot vegetate, so that fine tilth is equivalent to an extra quantity of seeds. For the same reason they must not be buried too deeply, or a large percentage will fail to germinate. A covering of half-an-inch is quite sufficient. The use of a Grass-seed Machine is recommended as better than sowing by hand. Particulars of a suitable Grass-seed Sowing Machine will be found on page 23.

SOWING WITH AND WITHOUT A CROP.

When permanent grass seeds are sown in spring it is usual to take a corn crop. This will always be a light one if the future welfare of the grasses is to be ensured. When a corn crop is not taken, 3 or 4lbs. of Rape, per acre, may be sown with the grass seeds; the Rape gives protection to the young grasses, and affords profitable sheep feed. As soon as possible after the cereal crop has been carried, any blank spaces should be made good, so preventing loss of crop and excluding objectionable weeds. The bare spots should be scratched with a rake, and some fresh seeds sown and raked in.

METHOD OF MIXING PERMANENT GRASS AND CLOVER SEEDS TO ENSURE THEIR REGULAR DISTRIBUTION WHEN SOWN.

In order to secure the most perfect distribution of the seeds of all the species over the entire surface of the field, the Light Seeds should form one mixture, and should be sown at one operation; and the Heavy Seeds should form a second mixture, to be sown at a second operation.

1st Mixture—LIGHT SEEDS.

Cocksfoot.	Rye-grass.	Chicory.
Foxtail.	Hard Fescue.	Burnet.
Meadow Fescue.	Tall Fescue.	Any other species.
Meadow Grasses (<i>Poas</i>).	Tall Oat Grass.	

2nd Mixture—HEAVY SEEDS.

Perennial Red Clover.	Late-flow. Red Clover.	Kidney Vetch.
Timothy Grass.	Alsike Clover.	Lucerne.
White Clover.	Yarrow.	Parsley.

To mix the seeds perfectly (a very important matter) they should be spread out in layers, one kind above another, on a clean floor, and then turned over with shovels several times until thoroughly mixed. It will be found most convenient to take each kind in the order stated above. Beginning then with Cocksfoot, spread this seed thinly and evenly on the floor (a wooden rake is most useful for spreading the seeds), then place the Foxtail thinly and evenly over the Cocksfoot, then similarly and successively the Meadow Fescue, Meadow Grasses, Rye-Grass, Hard Fescue, Tall Fescue, &c. When all the seeds that are to form one mixture are thus laid down, proceed to throw the whole into a heap, and then, with the aid of wooden shovels, turn over the heap, from side to side of the room, three or four times, until the whole of the seeds have been thoroughly mixed. The mixture may then be put into bags ready for sowing. The second mixture should then be prepared in the same way.

NATURAL GRASSES.

The Natural Grasses and their uses described. How to identify the seeds of the valuable species and those of inferior kinds used as substitutes or adulterants. The various weed seeds usually found in imperfectly-dressed samples of Natural Grasses.

Photo-micrographs of Natural Grasses and Weed Seeds are reproduced on pages 33 to 40.

ALOPECURUS PRATENSIS (*Meadow Foxtail Grass*).—Martyn observes of this valuable grass, that "it possesses the three great requisites of quantity, quality, and earliness in a superior degree to any other." Sinclair says that "it is one of the best grasses for permanent pastures, and should never form a less proportion than one-eighth of any mixture prepared for that purpose: its merits demand this whether with respect to early growth, produce, nutritive qualities or permanence." The opinions of these early writers, confirmed by subsequent experience, accurately sum up the universally acknowledged good qualities of this grass, and it only remains to add that it is indispensable in all permanent pastures on good moist soils. It thrives best on rich, moderately stiff, moist soils, and does well under irrigation, but does not grow well on poor dry soils, and there it is of little value. An erroneous impression exists that Meadow Foxtail does not attain its full productiveness until it is four years old, but Dr. Wilson has found that on a good stiffish loam, in comparison with the various species of grasses in general cultivation, "Meadow Foxtail seems to combine best productiveness and nutritive qualities." On account, however, of the higher price of its seed, Meadow Foxtail is not recommended for mixtures laid down for less than three years, as cheaper sorts are available.

There is probably no grass seed that varies so much in quality or affords greater opportunities for adulteration with other grass seeds of a worthless character than Meadow Foxtail. The seeds used for the purpose of adulteration are chiefly *Holcus lanatus*, *Alopecurus agrestis*, and Rye-grass, and as the seeds of these species are never harvested along with the Foxtail their presence is due to wilful adulteration. The seeds of *Holcus lanatus* (or Yorkshire Fog) and Meadow Foxtail, though enclosed in husks that closely resemble each other, will on comparison be found to differ so materially as to be readily distinguished. The chief points of difference are these:—The husk or outer covering of the seed of the Meadow Foxtail is furnished with an awn or hair nearly as long as the husk itself, and the edges of the husk are thickly set with fine silk-like hairs that are visible to the naked eye, the seed enclosed in the husk being *flat, brown in colour, and adhering to the husk*. The husk of the *Holcus*, however, is rather smaller than that of the Foxtail, is not furnished with an awn, and although there are short hairs on the edges of the husk of the *Holcus* yet they are only seen with a magnifying lens, and the seed enclosed in the husk is *egg-shaped, silvery, shiny, and readily separated from the husk*. *Holcus lanatus* is one of the most objectionable of grasses in pastures. It produces an abundance of seed which ripens early and is quickly shed, and as the flower heads are not touched by cattle, neither mowing for hay nor depasturing will prevent the increase of this worthless grass. The seeds of *Alopecurus agrestis* (Black Grass) were

formerly much used to adulterate the Meadow Foxtail. The points of similarity between *Alopecurus pratensis* and *agrestis* are these:—Both are terminated by an awn or hair nearly the length of the husk, and both are nearly flat, or else slightly concave on the front, and convex on the back. The points of dissimilarity are these:—In *A. pratensis* the colour of the husk enclosing the seed is greenish-white, the edges are clothed with silk-like hairs visible to the naked eye, and the seeds are very soft and smooth to the touch. In *A. agrestis* the colour is light brown, the edges appear to the naked eye to be quite free from hairs, and the seeds are thicker and longer than those of *A. pratensis*, and are hard and rough. The *Alopecurus agrestis* is a troublesome weed in arable land and valueless in any pasture. See figs. 7, 5 and 3.

Rye-grass seeds are also mixed with Meadow Foxtail, and as one Rye-grass seed is equal in weight to three well-matured Foxtail seeds, while the commercial value of Foxtail seed is six times greater than that of Rye-grass, it follows that a sample of Meadow Foxtail which contains even a small proportion of Rye-grass is of far less money value than one that is pure. Unripe seeds of *Aira cæspitosa* are nearly always found in samples of Meadow Foxtail. These seeds are not intentionally mixed with the seeds of the Foxtail, but are gathered with them at the time of collection. It is fortunate, however, that the seeds of the *Aira* ripen later than those of the Foxtail, and, being gathered in an unripe condition, very few germinate. See figs. 13 and 18.

Much of the seed of Meadow Foxtail is gathered unripe, so that frequently not more than five to ten per cent. will germinate. On the other hand, it is seldom that a higher percentage of germination than 85 is reached: This is chiefly due to the number of imperfect seeds contained in samples of Meadow Foxtail. These defective seeds are apparently good, but on the husks being opened some are found to contain the larvæ of a species of the insect *Cecidomyia* (Wheat Midge), while others contain the anthers of the unopened flowers. Such seeds cannot germinate, and they lower the percentage of germination to the extent that they exist in the sample. The larvæ of the Wheat Midge is of a bright orange colour, and cannot be mistaken for a seed.

ANTHOXANTHUM ODORATUM (*Sweet-scented Vernal Grass*).—One of the most generally distributed of the pasture grasses, growing in almost every kind of soil, but thriving best in soils that are moist, rich, and deep. It is also found in elevated mountain pastures and in secluded woods. It is one of the earliest grasses, but its yield is scanty, and its early produce not very nutritive; the later growth, however, is more nutritious. As a pasture grass it is of little value, and its herbage is not much relished by cattle or sheep. As the collection of the seed of this species is costly and usually greater than its worth, its use is not recommended.

The true *Anthoxanthum odoratum* is perennial and is indigenous to Britain, but a spurious annual species of continental origin is frequently sold for it. This annual species (*Anthoxanthum Puelii*) is a mere weed and of no value whatever. The seeds of these species resemble each other; but those of the true *A. odoratum* are longer than those of *A. Puelii*, and are almost black, while the seeds of the latter kind are brown. The collection of seed of the true *Anthoxanthum odoratum* is tedious, and only a small quantity is harvested, and it is therefore scarce and dear. The annual species (*A. Puelii*) produces seed freely, and it is harvested with little trouble. This seed may usually be had at about one-twentieth of the cost of the true species, so that large profits are made by the sale of it even at what seems to be a low price. See figs. 8 and 6.

AVENA ELATIOR (*Tall Oat-like Grass*).—Also known as *Arrhenatherum avenaceum* and *Holcus avenaceus*. The Tall Oat Grass is one of the hardiest, most productive and drought-resisting of our cultivated grasses, although it is only in recent years that its value has been as fully realized as it is now. Formerly its cultivation was chiefly confined to the continent, but its suitability for the Clifton Park System of grass-growing has now secured for it a more extended culture in the United Kingdom, where, but for the relative dearness of its seeds, it would be still more largely used not only for permanent pastures, but for one and two years' lays, as this species has the capacity of attaining maturity very quickly after sowing. The grass has a slightly bitter taste, but it is not the less liked by stock on that account, and it is as closely grazed in a pasture as any other species. It is found in all descriptions of soils, but its hardy and drought-resisting qualities render it specially valuable for those which are light and dry. The dearness of the seed of Tall Oat Grass is not apparent when comparing its price per lb. with that of other grass seeds, but, owing to the large size of its seeds, the number of them in 1 lb. is relatively small. Thus it happens that, with Cocksfoot and Tall Oat Grass seeds both at 1s. per lb., the cost of the Tall Oat Grass will be three and a quarter times that of the Cocksfoot. *Vide* Table at page 43, where the relative cost per million germinating seeds of all the grasses is given.

The Tall Oat Grass under notice (which is *fibrous-rooted*) must not be confounded with the *bulbous-rooted* variety of Oat Grass known under the name of "Onion Couch," "Button Couch," etc., which is so great a pest on some arable lands. A comparison of the roots of these two grasses will at once demonstrate the great difference that exists between them, although they are so similar in appearance in respect of their growth above ground.

Impure samples of Tall Oat Grass mixed with seeds of brome and other inferior grasses are met with, though these are not necessarily due to wilful adulteration, but rather to careless harvesting. Such impurities cannot, however, be removed, as the Tall Oat Grass seed does not lend itself to ready separation from other kinds, so that it is necessary that the seed of Tall Oat Grass should be harvested from a pure source. *See* fig. 4.

AVENA FLAVESCENS (*Golden Oat Grass*).—This species grows naturally in almost every kind of soil and in many situations. It succeeds on dry calcareous soils, and also in irrigated meadows, and it is always found in the best natural pastures. It seems to thrive best in dry or moderately moist soils; and although from its fine habit of growth its produce is not very abundant, it deserves a place in the composition of all pastures on these soils. The Golden Oat Grass continues to grow freely during the latter part of the season, and is thus valuable for keeping up a good yield of grass to a late period. It thrives in exposed or upland pastures, and sheep are fond of it.

The seed that is often supplied for *Avena flavescens* is of an entirely different species, viz., the *Aira flexuosa* (Wavy Mountain Hair Grass). The seeds of these Grasses are somewhat like each other, but the seed of the *Aira flexuosa* is plentiful and cheap, while that of *Avena flavescens* is scarce and dear. To the naked eye the seeds of *Avena flavescens* are light, slender, and of a pale brown colour, while those of *Aira flexuosa* are heavier, thicker, and of a darker brown colour. Under the microscope the points of difference are as follows: the *Avena flavescens* has a long twisted and bent awn which *springs from the back* of the seed, near the top or thinner end. At the base or thicker end *short white hairs* encircle the seed, and these hairs are also continued up the

front or concave side of the seed. The *Aira flexuosa* has also a long bent awn, but it springs from the base or thick end, passes up the back of the seed, and does not adhere to it. The lower end of the seed of *Aira flexuosa* is encircled with long white hairs, but there are no hairs on the front of the seed. Although these seeds resemble each other so remarkably, it will be noticed that the differences, indicated by italics, are unmistakable. See figs. 1 and 2.

CYNOSURUS CRISTATUS (*Crested Dogtail Grass*).—The value of this species, which is much liked by sheep, is greatest at the time of flowering. If left until the seeds ripen, the culms (or stems) lose the whole of their nutritive value, and are then always left untouched by stock. As the culms are very wiry they remain until the following year, presenting in the meantime a somewhat unsightly appearance. The leaves, which are short and form a dense turf, retain their green appearance, even in dry summers, longer than most grasses. The Crested Dogtail thrives in a great variety of soils—from the dry upland pasture to the irrigated meadow, but, compared with the best large-growing grasses, its produce is very scanty. This grass has lately fallen very much in the estimation of close observers of permanent grasses, and as it is only entitled to rank as a third-rate kind on good rich soils, its use on such soils is not recommended. It is, however, a useful grass for upland sheep pastures, but is unsuited for hay crops, on account of the scantiness of its yield. When included in mixtures for permanent pasture, on good soils, the quantity of seed used should be very small, as when once established it will increase from year to year by self-sowing, and in this way may become far too abundant, to the exclusion of other sorts of greater value.

Crested Dogtail is sometimes adulterated with *Molinia cærulea*, a grass which has hardly any agricultural value, having stems so rigid and tough that they are used for making brooms, ropes, mats, &c., proving its unsuitability for permanent pastures. The *Molinia* grows abundantly on moor and heath lands, and as its seeds can be collected very cheaply, it is profitably used in the adulteration of such expensive seeds as Crested Dogtail. The seeds of *Molinia cærulea* are larger in size, lighter in weight, and darker* in colour than those of Crested Dogtail. The presence of *Molinia* in a sample of Dogtail may be detected by shaking a small quantity on a sheet of paper, when the seeds of the *Molinia*, being larger and lighter, will rise to the top. The naked seeds of *Holcus lanatus* are also often found in Crested Dogtail, which is due to careless collection, and if the two seeds are harvested together they cannot be perfectly separated, owing to the diameters of the two species being almost equal. Such samples must be scrupulously rejected, as no *Holcus* should be admitted into any permanent pasture. Under the head of *Alopecurus pratensis* will be found a description of *Holcus lanatus* in the husk, in which condition it is used to adulterate that grass, but it is in its naked state that it is met with in Crested Dogtail. It is then egg-shaped, silvery, and shiny, and its glistening appearance at the bottom of a sample of Dogtail should quickly lead to its detection. See figs. 20 and 3.

DACTYLIS GLOMERATA (*Cocksfoot Grass*).—A very common species, growing in almost all soils and situations—in meadows, woods, and by roadsides. Though it looks coarse, it is one of the earliest, most productive, nutritious, and valuable of the cultivated grasses, and it comes quickly to perfection. It thrives in a great variety of soils, and as its roots penetrate to a considerable depth, it withstands drought better than most other grasses on light dry soils. This grass is sometimes condemned because of its coarseness—which is so apparent when improperly treated—but with proper

management no species is more valuable. When grazed it should not be allowed to become coarse, but should be kept closely cropped. In this condition it is highly nutritive, its produce is enormous, and it is relished and greedily eaten by all kinds of stock. If not kept under proper control, but allowed to grow rank and woody, its nutritive value and productiveness are lessened, and the plant assumes a coarse and unsightly appearance. Mr. De Laune says of Cocksfoot that it "is by far the most valuable of all grasses because it grows in all soils; it produces the greatest amount of keep; it is the most nutritious grass, and seems to grow faster and stronger in extremes of weather, either wet or dry, than any other grass." When grown for hay, Cocksfoot should be mown at the time of flowering, as the produce decreases in weight and becomes less nutritious after that time. For permanent pasture, for alternate husbandry, or for hay, there is not a more valuable grass, and its liberal use for all these purposes, on every description of soil, is strongly recommended.

It is sometimes said of Cocksfoot that it does not come to maturity soon enough to yield a full hay crop the first year after sowing, but this is not so, provided a sufficient quantity of heavy seed of high germination is used. As there is much Cocksfoot seed of light inferior quality and with a low germination used in grass seed mixtures, the results obtained from such sowings must be unsatisfactory, but if good-growing heavy seed (weighing from 22 to 24 lbs. per bushel) be used, the yield of hay or grazing the first year after sowing will be all that can be desired. Our contention in this respect is supported by Sinclair, who says of Cocksfoot that "for alternate husbandry, it appears to have a greater variety of merits than almost any other grass. It soon arrives at maturity, it bears cropping well, is very productive, and its nutritive powers are considerable. It is much less impoverishing to the soil than rye-grass, and when ploughed it affords a greater quantity of vegetable matter to the soil. It has been objected to Cocksfoot that it rises in tufts, and is apt to become coarse. But this objection will apply to every grass that is not sown sufficiently thick to occupy with plants every spot of ground, and that is not sufficiently stocked to keep the surface in a succession of young leaves. It is the practice of thin sowing, and the strong appearance of the plant, that occasion it to appear a hassocky grass."

The Cocksfoot seed used in this country is chiefly obtained from New Zealand and America. In samples of the former, seeds of *Holcus lanatus* (both naked and in the husk) and *Bromus mollis* are usually found, while in those of American origin docks are prevalent. These injurious seeds are not intentionally mixed with the Cocksfoot, but are harvested with it. Such samples are, however, most objectionable, and, in their undressed state, should be carefully avoided. Cocksfoot is sometimes adulterated with small seeds of perennial Rye-grass. This increases the weight of the sample, and gives to the Cocksfoot an apparently higher percentage of germination, which is really due to the presence of the Rye-grass seed. An important factor in judging of the quality of a sample of Cocksfoot (and this remark applies to almost every other species of grass seed) is its weight. The appearance of a sample of Cocksfoot weighing 12 lbs. per bushel may be quite as good as that of one weighing 24 lbs. per bushel, but the 12 lb. seed will consist chiefly of empty husks destitute of seed kernels, whilst the 24 lb. seed will be composed entirely of fully-developed seeds, 95 per cent. of which should be capable of germinating, while the 12 lb. seed will not have a germinating capacity of more than about 15 to 20 per cent. The weight per bushel of any sample of grass seed affords one of the best tests of quality. See figs. 9, 3, 13, 17 and 54.

FESTUCA ELATIOR (Tall Fescue Grass).—This is a grass of large growth, and it is early, nutritive, and productive. It resembles the Meadow Fescue, but is larger in every respect. It is especially suitable for tenacious clays or wet soils, but it is also equally suitable for light dry soils, and its drought-resisting qualities have secured for it an important place in the Clifton Park system. Until 1884 this grass was generally understood to thrive only on heavy or wet soils, but in the exceptionally dry summer of that year Mr. De Laune discovered that plants of the Tall Fescue retained their fresh green colour, and continued to grow when all other grasses in the same pastures were suffering from the excessive and long-continued drought, and subsequent experience has proved this species to be one of the best deep-rooting and drought-resisting grasses we have. It is one of the five best grasses for permanent pasture, and may be sown on every description of soil. Sinclair describes it as: "One of the earliest grasses with regard to production of foliage early in the spring. It is nutritive and very productive. It is true, the produce may be denominated coarse when compared to the *Festuca pratensis*, *Alopecurus pratensis*, and other of the superior grasses; but where is a grass to be found that produces a great weight of crop that is not in some degree coarse?" Objection to the true Rhenish Tall Fescue on the ground of coarseness is no longer raised, and it is now one of the most popular of our pasture grasses.

The market value of the seed of Tall Fescue is usually twice that of Meadow Fescue, and on this account the latter is often supplied for the former. The Consulting Botanist of the Royal Agricultural Society of England reported in December, 1883: "I have examined eighty-five samples of Meadow Fescue and Tall Fescue. I include them both under the same head, for, with the exception of three or four cases, all the samples sold as Tall Fescue were really Meadow Fescue." When buying this seed the necessity for ensuring a supply of genuine seed is obvious. Our illustrations of the seeds of *Festuca elatior* and *Festuca pratensis* (see figs. 11 and 12) show that the seed of the former is long and tapering to a point, while the latter is shorter, and of nearly uniform width throughout. There is always a difference in colour between the seeds of the two species, the Meadow Fescue being usually of a fair straw colour, while the Tall Fescue seeds are always darker. Absolutely pure seed of *Festuca elatior* is not usually met with, the purest samples generally containing a small percentage of Cocksfoot, and, perhaps, Meadow Fescue, but such a trifling admixture being unintentional and unavoidable, is of little consequence. Admixture becomes serious, however, when Meadow Fescue or Rye-grass seeds are wilfully added as adulterants, as the value of the sample of so-called Tall Fescue is much lessened thereby. The chief points of difference between the seeds of Rye-grass and Fescue are given under the head of *Festuca pratensis*, *vide* page 54. The best and purest *Festuca elatior* (Tall Fescue) seed of the species most valuable for permanent pastures in the United Kingdom is of Rhenish growth, and no other seed is comparable with it. The supply of this seed is very limited, and in recent years the demand for it has been greater than the supply. It behoves the buyer, therefore, to be assured of the origin of the seed he uses, or disappointment may result. Much seed of the New Zealand Reed Fescue has been imported from that colony, and sold in this country as *Festuca elatior*. The seed of this colonial species can be obtained at a low price, but its coarse reedy habit of growth renders it quite unsuitable for laying down land to permanent pasture, and care should be taken to reject it. The seeds of the New Zealand Fescue have a general resemblance to those of genuine *Festuca elatior*, but they are larger and paler in colour. New Zealand samples frequently contain ergot. See figs. 11, 12, 9 and 13.

FESTUCA DURIUSCULA (*Hard Fescue Grass*).—This grass *Festuca ovina* (Linnæus), var. *duriuscula* (Koch), is known commercially by the names of Hard Fescue and Sheep's Fescue, and under both these names seed of the *Festuca duriuscula* is bought and sold. Stebler says "*Festuca duriuscula*, the hard fescue of commerce, is a vigorous variety of genuine sheep's fescue." We adopt the name *duriuscula* and supply seed of that variety which is the most useful of the smaller fescues for permanent pasture. Hard Fescue is adapted to a great variety of soils. It is most prevalent in those that are light and rich, though also found in fertile and moist natural pastures, as well as in irrigated meadows. It is equally accommodating as regards situation, thriving not only in the rich lowlands, but also on mountain pastures at an elevation of two thousand feet. This grass possesses the quality of withstanding, in an exceptional degree, drought in summer and severe cold in winter. Although possessing these qualities, however, it is not to be compared with either the Tall or Meadow Fescues as a pasture grass on good soils at a moderate elevation. But it has its uses as a bottom grass, and for growing in situations where the superior grasses may not thrive so well.

This is one of the few cultivated grasses the seeds of which are not often designedly adulterated, but samples are sometimes found mixed with *Molinia cærulea*, and in this case the adulteration is intentional. In inferior or improperly dressed samples, seeds of *Bromus mollis* and *Rumex acetosella* (Sheep's Sorrel) are always found. *Molinia cærulea* is described under the head of *Cynosurus cristatus*, *Bromus mollis* under *Festuca pratensis*, and Sheep's Sorrel under *Trifolium repens*. It is almost needless to add that samples of Hard Fescue containing those impurities should be rejected. See figs. 10, 17 and 72.

FESTUCA OVINA (*Sheep's Fescue*). See *Festuca duriuscula*.

FESTUCA OVINA TENUIFOLIA (*Fine-leaved Sheep's Fescue Grass*).—This grass being remarkable for the fineness of its leaves is well adapted for lawns, and particularly for those on dry soils, but the insignificance of its produce makes it of little value in permanent pastures.

The seeds of *Festuca ovina tenuifolia* are less than half the size of those of *F. duriuscula*, and are awnless, while the seeds of *F. duriuscula* are terminated by an awn. By these differences the two may be easily distinguished. The smallest seeds sifted out of *F. duriuscula* are not infrequently substituted for those of the variety under notice, but even they are larger than the seeds of *F. ovina tenuifolia*. A mixture of *F. ovina tenuifolia* and the small seeds of *F. duriuscula* is also produced; and, finally, the seed of *F. ovina tenuifolia* mixed with *Molinia cærulea*, is among the commonest forms of adulteration to which this grass is subject. *Molinia cærulea* is described under the head of *Cynosurus cristatus*. See figs. 19 and 10.

FESTUCA RUBRA (*Red or Creeping Fescue Grass*).—The Red Fescue is, from an agricultural point of view, an inferior grass, and it is not entitled to a place in permanent pastures in the United Kingdom as much better grasses are readily available. In appearance it somewhat resembles the Hard Fescue, but differs from that grass in having creeping under-ground stems, like couch grass. It is drought-resisting, and grows on sandy links by the seaside.

Genuine seed of *Festuca rubra* is seldom met with, and the seeds usually supplied for it are the larger-seeded and rougher looking samples of *Festuca duriuscula*. Seed of the Chewings Fescue grass of New Zealand is also sold under the name of Red Fescue.

FESTUCA PRATENSIS (*Meadow Fescue Grass*).—The valuable properties of this species are universally acknowledged. It is one of the six grasses specially recommended by Curtis for laying down moist or moderately dry soils to permanent pasture, and no grass has a stronger claim to this position. Sinclair says of it: "The Meadow Fescue constitutes a very considerable portion of the herbage of all rich natural pastures and irrigated meadows; it makes excellent hay, and though a large plant, the leaves or herbage are succulent and tender, and apparently much liked by cattle, as they never form rank tufts, which is the case with the larger grasses." Stebler speaks of it as: "One of the most valuable grasses either for mowing or pasture, as it is very productive, and the fodder good. Being perennial, it ought always to be represented on permanent grass lands which are suitable for its growth." It thrives best on moist soils rich in humus, but it can also be grown on sandy soils if they are sufficiently moist. On poor dry soils it is of little value as moisture is essential to its success. This grass should form a chief part of all permanent or temporary pasture mixtures on good soils, and also on light soils that are not too dry. It is characteristic of this grass that between the time of flowering and the ripening of its seeds it decreases in nutritive value, so that when left for hay it should be cut when in flower, as then its nutritive value is three times greater than when the seed is ripe. As, however, the seed is not ripe until about the first of August, the sowing of this valuable grass along with Rye-grasses, Cocksfoot, &c., for hay crops or alternate husbandry, need not be restricted, as the seeds of these grasses ripen two or three weeks earlier than those of the Meadow Fescue, so that such hay crops would be ready for mowing at the time the Meadow Fescue was in flower and in its most nutritious state.

So closely to the naked eye do the seeds of Meadow Fescue resemble the seeds of perennial Rye-grass, that abundant opportunities for adulteration are afforded, and previous to 1883 it was quite exceptional to find a pure sample of Meadow Fescue. Since that time, however, a marked improvement in the quality and purity of this seed has taken place, and now there is not the least difficulty in obtaining seed perfectly free from Rye-grass, and its presence may with almost absolute certainty be put down to wilful adulteration. Samples of seeds sold as Meadow Fescue have been found to contain not more than ten per cent. of Meadow Fescue, the remaining ninety per cent. being Rye-grass. The fact that the price of Rye-grass is usually about one-fourth that of Meadow Fescue, sufficiently explains the motives of those who mix these seeds. Examined with the aid of a magnifying lens, the seeds of these two grasses may be readily distinguished, and the chief points of difference are these:—in the Meadow Fescue, the small stalk which springs from the lower end of the face or front of the seed is slender, is of one thickness throughout, and flanged at the top. In perennial Rye-grass this stalk is shorter and broader, it is wide at the top, and tapers towards the base, it is not flanged at the top, and it lies closer to the seed than in the Fescue. With careful observation of these points an adulterated sample of Meadow Fescue may be detected and the percentage of Rye-grass determined. Seeds of *Bromus mollis* and *Bromus secalinus* are also to be found in Meadow Fescue, but these are harvested with the Fescue. They should, however, be removed, as both are troublesome weeds. The seeds of *Bromus mollis* are nearly twice the size of Meadow Fescue, are broad and open, and are terminated by an awn about the same length as the seed itself. The seeds of *Bromus secalinus* are of nearly the same length as *B. mollis*, but they are more cylindrical in shape. *B. secalinus* is also furnished with an awn. Meadow Fescue has no awn. See figs. 12, 13, 15 and 17.

LOLIUM ITALICUM (*Italian Rye-grass*).—The Italian Rye-grass originated in Lombardy, and was introduced into Britain in 1833, by the late Mr. Charles Lawson. No agricultural grass of greater value has been brought into notice during the last century. As regards its nutritive value, earliness, productiveness, and quickness of growth after it has been mown, it far surpasses the perennial Rye-grass. It is therefore indispensable for alternate husbandry; but, being a biennial plant, it does not live more than two years. Sown in temporary or permanent pastures, however, it does not disappear in that time, as, when left for hay, a succession of plants is reproduced from the seeds which are ripened and shed early in the season; or if the pasture is grazed the duration of the Italian Rye-grass is lengthened by its not being permitted to produce seed. But the seed of this grass must be sparingly used in mixtures for permanent pasture, otherwise the spaces vacated by the Italian Rye-grass will most likely be occupied by such worthless grasses as *Holcus lanatus*, *Bromus mollis*, *Poa annua*, &c. It has been conclusively demonstrated that the addition of not more than three pounds of Italian Rye-grass seed per acre to permanent grass mixtures materially promotes the earliness and increases the yield of the pasture the first season, either in the shape of early spring grazing for ewes and lambs or in the heavier yield of the first hay crop, while this limited quantity has no harmful effect, as the spaces vacated by the decreasing Italian Rye-grass plants are filled by the extension of the permanent grasses. On moist rich soils and under irrigation, the rapidity of growth and productiveness of Italian Rye-grass are really wonderful. The weight of produce of one year's growth of Italian Rye-grass compared with one year's growth of perennial Rye-grass, is as 23 to 14; and if it is borne in mind that in nutritive value it is superior to perennial in the proportion of 35 to 28, there will surely be no hesitation in giving preference to Italian Rye-grass for use in alternate husbandry on all suitable soils.

French-grown Italian Rye-grass seed has heretofore been considered the best in respect of earliness and productiveness; but the seed which is now harvested in large quantities in the north of Ireland is, in favourable seasons, of very superior quality. Some recent comparative trials have shewn the Irish to be equally as productive as the French. French seed as imported from the growing districts always contains many weed seeds, as well as sand and other refuse, so that imported seed should never be sown until it has been thoroughly re-cleaned. The best class of Irish seed is marketed in a much purer condition. The weed and other seeds usually found in Italian Rye-grass are *Ranunculus acris* (Upright Buttercup), *Ranunculus repens* (Creeping Buttercup), *Medicago lupulina* (Trefoil) in the husk, *Holcus lanatus* (Yorkshire Fog), *Bromus mollis* (Soft Brome Grass), *Festuca sciuroides* (Squirrel-tail Fescue Grass), *Plantago lanceolata* (Rib-grass), *Lapsana communis* (Nipple-wort), *Chrysanthemum leucanthemum* (White Ox-eye), *Myosotis* (Scorpion-grass), *Rumex obtusifolius* (Broad-leaved Dock), &c. The Buttercup seeds and Trefoil seed in the husk are flat and disc-like, and cannot fail to be recognised. The *Festuca sciuroides* (commonly known to seedsmen as Hair Grass) and *Bromus mollis* both have awns like the Italian Rye-grass, but the *F. sciuroides* is very long, is dark coloured and very slender, the seed of the *Bromus mollis*, although rather like the seed of Italian Rye-grass, being much broader. Any of the other weed seeds mentioned may be detected with little difficulty, as they have no resemblance to the seed of Rye-grass. Italian rye-grass is sometimes adulterated with light grass seeds obtained from hay lofts. These seeds are of a worthless description and usually consist of Yorkshire-fog and soft-brome grasses, undeveloped rye-grass seeds, and weed seeds. See figs. 16, 3, 17, 24, 14, 56, 58, 35, 57, 74, 61, 73 and 54.

LOLIUM PERENNE (*Perennial Rye-grass*).—The Perennial Rye-grass grows nearly everywhere and on all soils. It possesses the merit of a free vegetation on any soil and an early spring growth. It makes an excellent show the first year, but after that time, and more particularly on poor light soils, it begins to deteriorate, and gradually disappears during the second and third years. On good rich soils it is more permanent, but on such soils other grasses of far superior quality should be grown, being so much more profitable and permanent. Being a shallow-rooted grass the Perennial Rye-grass soon suffers from drought, so that on dry light soils, in a climate subject to drought, preference should be given to Cocksfoot and other drought-resisting species. It has long been known that Perennial Rye-grass was a grass of inferior merit, and attention has been directed to this fact by eminent authorities from time to time during the last hundred years, but it is only in recent years that its excessive use has been stayed. In 1805, Curtis, in his "Practical Observations on the British Grasses," says:—"Ray-Grass (or ryegrass) still continues to be the only grass whose seed can be purchased for the purpose of laying down meadow and pasture land; and how inadequate that grass is, for such a purpose, is known to every intelligent farmer. Why, indeed, the *Lolium perenne* should originally have been made use of, in preference to all the other grasses, cannot, perhaps, be satisfactorily accounted for; most probably it owes its introduction to accident, or to its being a common grass whose seeds were easily collected, rather than to its being preferred from any investigation of its merits compared with the others." Sinclair says of it in the 2nd edition of *Hortus Gramineus Woburnensis*, 1825, "Let the produce and nutritive powers of Rye-grass be compared with those of the Cocksfoot grass, and it will be found inferior in the proportion nearly of 5 to 18; and also inferior to the Meadow Foxtail in the proportion of 5 to 12; and inferior to the Meadow Fescue in the proportion of 5 to 17."

In 1882 Mr. de Laune, in his famous paper on "Laying down Land to Permanent Pasture," denounced the excessive use of perennial rye-grass, and this gave rise to the great "rye-grass controversy" of the 'eighties. Mr. de Laune's lead was followed by Mr. Robert H. Elliot, and his work at Clifton-on-Bowmont, where no perennial rye-grass has been sown for the last 15 years, has clearly demonstrated that the heaviest crops of grass can only be obtained from mixtures from which perennial rye-grass is excluded. The excessive use, during the last century, of perennial rye-grass in grass mixtures could only be excused by the plentifulness of its seed and its apparent cheapness (although the latter is much more apparent than real, as the reader will observe if he will refer to the table on page 43, where the cost per million seeds of all the cultivated grasses is given), and the difficulty of obtaining good seeds of the better grasses, but the latter excuse holds good no longer, as the seeds of all the cultivated grasses are now obtainable of a very high standard of quality, and ordinarily, at moderate rates. The grasses that should, in our opinion, be preferred to perennial rye-grass are Italian rye-grass, Cocksfoot, Meadow Fescue, Timothy, &c. Where it is thought desirable to include perennial rye-grass in the mixture we should never use more than 5 lbs. per acre. It is important to remember that a large seeding of perennial rye-grass is antagonistic to the success of red clover.

Rye-grass seed is sold under many different names, *e.g.*, Pacey's, Devon Ever, Evergreen Rye-grass, Fine-leaved Rye-grass, &c., but these names are meaningless and do not represent different varieties. Rye-grass seed is graded according to its weight and quality, and the only difference that exists between one sample of rye-grass and another is that of weight and purity. The heaviest weighing and purest seeds are machined, and such seed represents the highest grade, weighing 26 to 28 lbs. per bushel. Such seed may be sold as Pacey's, Devon Evergreen, or by any other name that may be fancied. In like manner

the lighter-weighting growths are machined and graded according to weight, and range from 20 to 24 lbs. per bushel. Inferior and light-weighting seeds form the lower grades, weighing from 14 to 18 lbs. per bushel. It is false economy to buy light seed although apparently cheap, as twenty bushels of 14 lb. seed will not produce as many rye-grass plants as one bushel of 28 lb. seed, although undoubtedly a great many more weeds will result from the light seed.

Perennial Rye-grass seed of good and heavy quality—from 24 lbs. to 28 lbs. per bushel—may be had very free from weed seeds, but lighter and cheaper samples always contain a large proportion of the seeds of *Holcus lanatus* (Yorkshire Fog). Perennial Rye-grass seed of less weight than twenty-four pounds per bushel cannot be thoroughly cleaned, so that lighter samples should not be used. The weed seeds to be found in Perennial Rye-grass are *Holcus lanatus* (Yorkshire Fog), *Bromus mollis* (Soft Brome Grass), *Bromus secalinus* (Rye-seeded Brome Grass), *Festuca sciurioides* (Squirrel-tail Fescue Grass), *Ranunculus acris* and *repens* (Buttercups), *Plantago lanceolata* (Rib-grass), and *Trifolium procumbens* (Hop Trefoil) in the husk. See figs. 13, 3, 17, 15, 14, 56, 58, 57 and 70.

PHLEUM PRATENSE (*Catstail or Timothy Grass*).—A much esteemed and extensively cultivated grass which increases in popularity as its merits become better known. Introduced into England in the middle of the eighteenth century from the United States, where it was cultivated by Timothy Hansen, by whose name the grass is still known, it is extensively grown on account of its valuable properties and usefulness. It is very productive, of high nutritive value, and it has the merit of being the cheapest of all the grasses that the farmer can sow. The Timothy Grass produces seed in abundance, and as the seeds are small in size (over 1¼ million are contained in 1 lb.), no other grass seed costs so little, and the fullest advantage should be taken of this fact when seeding down soils suitable for its growth. On heavy and moist loams and clays, and also on peaty soils, it thrives well. It also grows on dry soils, but there its produce is much smaller, as a sufficiency of moisture is indispensable for full productiveness. It does well under irrigation, is deep-rooted, very hardy, and resists extreme cold. Timothy is a late-flowering grass, but it produces an abundance of early herbage which may be grazed until late in spring before shutting up for the hay crop. The crop should not be cut too late, otherwise the hay becomes hard. Cut before the crop is in flower the hay is very nutritive, and excellent for horses in heavy work. Sinclair says of Timothy Grass:—"The Meadow Catstail is remarkable for its weighty produce of culms, which "are more nutritive than those of any other grass, but the aftermath is very inconsiderable; it is in consequence a most valuable grass for hay, but requires to be combined with other species of grass whose produce consists chiefly of lattermath, to "render its culture so profitable, as it doubtless is, for hay."

There is no difficulty in procuring good and pure seed of this species, and owing to the bright silvery appearance of the outer covering of the seed, any weeds or impurities are readily observed. American and Canadian Timothy seeds are harvested in a riper condition than that of Continental growth, and thus have a larger proportion of the seeds separated from the husk or outer covering, which gives the samples a darker appearance. As, however, they are usually very heavy and well ripened, their germination is excellent, and they are generally very free from weed seeds. The weed seeds usually met with in Catstail are *Plantago major* and *Plantago lanceolata* (Rib-grasses), *Rumex acetosella* (Sheep's Sorrel), *Prunella vulgaris* (Self-heal), and *Rumex obtusifolius* (Dock), but all these seeds can be readily detected. See figs. 21, 64, 57, 72, 69 and 54.

POA ANNUA (*Annual Meadow Grass*).—This grass can only be classed as a weed, as it usually occupies the place of more profitable species. Although an annual, its seeds are produced nearly the whole year, and so a constant succession is kept up. See fig. 24.

POA FERTILIS (*Fertile Meadow Grass*).—Resembles *Poa nemoralis*, but is of larger growth. It has the merit of being a very early and a very late grass, thus extending the period of productiveness of any pasture of which it forms a part. Grows on all soils, but prefers those which are moist.

POA NEMORALIS (*Wood Meadow Grass*).—This grass is commonly found growing naturally in woods and shady places, but it also grows freely when sown in open situations. Its pleasing green colour and fine herbage adapt it for sowing with other fine-leaved grasses for lawns and pleasure grounds, and when these are much shaded by trees, no grass is more suitable, but the smallness of its produce, and the usually high price of its seed, are sufficient reasons for restricting the use of this grass to ornamental purposes only. *Poa nemoralis* is sometimes called *Poa nemoralis sempervirens*, but there is no difference of variety, the same seed being sold under both names.

The seed of *Poa nemoralis* is frequently adulterated with that of *Aira cæspitosa* (Tufted Hair Grass or Hassock Grass). Closely examined by the naked eye, the seeds of *Aira* will be recognised in a sample of *Poa nemoralis* by their shiny silvery appearance, but it is desirable to make use of a magnifying lens. So viewed, the seeds of *Aira cæspitosa* appear egg-shaped, thicker at the lower end, and tapering towards the top. They are also shiny and silvery, and are encircled at the lower end with numerous white hairs, which spring in an upward and outward direction from the lower end of the seeds. The seeds of the *Poas* have none of these characteristics, although they are of about the same size as those of the *Aira*. The *Aira* is a most pernicious weed, and being difficult to eradicate from damp soils should be carefully excluded. The seeds of *Glyceria distans* are also used as an adulterant; and the seed of *Poa pratensis* is not uncommonly substituted for that of *Poa nemoralis*. See figs. 22, 18 and 25.

POA PRATENSIS (*Smooth-stalked Meadow Grass*).—The Kentucky Blue-grass. In the United States this grass is highly esteemed, but in the United Kingdom it is surpassed by the Rough-stalked Meadow Grass. The creeping underground stems of the Smooth-stalked Meadow Grass—not otherwise a commendable feature—enable it to withstand great drought, and it is thus of considerable value for growing in light, dry and sandy soils, but for general purposes in the moist climate of the United Kingdom, the Rough-stalked Meadow Grass is to be preferred.

Sinclair says: "The *Poa pratensis* cannot justify its claim to a place in the common position of the best natural pastures, and on this account should be carefully avoided "as an unprofitable plant for that purpose." Johnson, in his *Grasses of Great Britain*, confirms Sinclair's views, and adds: "Thus, a grass once regarded as being among the "most useful of British species, and under this view still dispensed by our unpractical "seedsmen, is considered by most experienced cultivators as a weed." Compared with " *Poa pratensis* the herbage of *Poa trivialis* is twenty-five per cent. more nutritious; and whereas *P. pratensis* is creeping-rooted, *P. trivialis* is fibrous-rooted—two strong reasons why *P. trivialis* should be used on all superior soils in preference to *P. pratensis*.

Seed of *Poa pratensis* is plentifully produced, and that sold is usually genuine, although samples adulterated with *Aira cæspitosa* are sometimes seen. The seed of *Poa compressa*, the Canadian Blue-grass, an inferior variety of *Poa pratensis*, is, however, sometimes substituted for *Poa pratensis*. See figs. 25, 23 and 18.

POA TRIVIALIS (*Rough-stalked Meadow Grass*).—This species grows in perfection on moist rich soils in sheltered situations, and no grass is more relished by all kinds of stock. It is valuable on account of its fine close growth, productiveness, and highly nutritive qualities, and it should therefore be present in all permanent pastures on good soils. As a “bottom” grass it is unsurpassed, but it does not thrive when grown alone, or when much exposed to the sun in a dry situation. In summer, during dry hot weather, it ceases to grow, but later in the season, after rain, it soon starts into growth, and continues growing through the winter during mild weather. Its spreading habit enables it to fill up the bare spaces between the larger plants in a pasture, thus keeping out objectionable grasses or weeds, and preventing loss of moisture. In this respect the Rough-stalked Meadow Grass is most valuable, and no permanent pasture on good soil should be laid down without it. It thrives best in rich, moist loams and alluvial soils, by river sides, and under irrigation. Under the most favourable conditions as regards soil, moisture, and shelter, its growth is very considerable; but even on light soils it is worthy of a place, as it has no equal in regard to its filling up the bottom of a pasture and keeping out undesirable species.

Up to the year 1882, when Mr. de Laune published his paper on “Laying-down Land to Permanent Pasture” and showed the impossibility of obtaining pure and genuine grass seeds, no genuine seed of *Poa trivialis* could be obtained in the United Kingdom; seed of *Poa pratensis* was invariably supplied for it. Since the introduction of the system of guaranteeing the genuineness of grass seeds, introduced by James Hunter in 1883, genuine seed has been obtainable, and now there is not the least difficulty in getting it, or any other permanent grass, of pure and genuine quality. As seen by the naked eye, and in their natural condition, before being dressed, the seeds of *Poa trivialis* are small and slender, and they do not adhere to each other to any very great extent; while the seeds of *Poa pratensis*, besides being larger and broader, adhere very much to each other in masses, owing to the large tuft of woolly-like hairs at the end of the seeds, and the three rows of hairs on the keel and ribs. Were these seeds sold in their natural state there would not be any difficulty in distinguishing them even by the naked eye; but in the process of machining, the hairs which are abundant in *pratensis* are removed, and it is then impossible, without the assistance of a microscope, or powerful magnifying lens, to discriminate between the two kinds. A careful examination of the seeds of both species in their natural state will show the following characteristics:—The seeds of *trivialis* have a neat, slender, and tapering appearance, have short hairs on the keel or back, and a small tuft of long hairs at the thicker end or base, *but there are no hairs on the edges of the face or front of the seed*. The seeds of *pratensis* are broader, have a rougher appearance, and are very hairy; the hairs on the keel or back are long; the tuft of hairs at the base is larger, *and the edges of the face or front for about half the length of the seed are covered with hairs*. The most striking difference between the two species is the presence of hairs on the edges of the face of *pratensis*, and their absence from the same part of the seed of *trivialis*, and although many of the hairs may have been removed from highly machined samples of *pratensis* prepared to resemble *trivialis*, some usually remain to attest the identity of *pratensis*. *Aira cæspitosa* is used to adulterate all the species of *Poa*, but it is most commonly found in *Poa nemoralis*. A description of *Aira cæspitosa* will be found under the head of *Poa nemoralis*. The seeds of *Molinia cærulea* are sometimes used to adulterate *Poa trivialis*, but the seeds of *Molinia* are nearly three times the size of the seeds of the *Poa*; *Glyceria distans* is also used as an adulterant of this species. See figs. 23, 25, and 18.

Artificial Grasses

(Clovers, etc.)

Photo-micrographs of Clover Seeds and the Weed Seeds usually found amongst them are given on pages 33 to 40.

RED or BROAD-LEAVED CLOVER (*Trifolium pratense*).—The Red is the most valuable of all Clovers for one year's lay, either grown alone or in mixture with grasses and other Clovers. It succeeds best in good and rather stiff soils containing some lime. No fodder plant surpasses the red clover in importance, and when successfully grown, it is at once a profitable and indispensable farm crop and a valuable manurial agent. All red clovers, in common with other leguminous plants, have the valuable quality of obtaining and storing atmospheric nitrogen in the wart-like growths or nodules which are produced on their roots, and which in due course provide an ample supply of nitrogen to the wheat or other cereal crop that may follow the clover. See fig. 32.

PERENNIAL RED CLOVER (*Trifolium pratense perenne*), commonly called "Cow-GRASS."—This is the variety of Red Clover usually found in old pastures. It is more durable than the common broad-leaved Red Clover, and is therefore recommended for permanent pastures, particularly those on medium and heavy soils; on light soils it does not remain long in the land, and on such soils it should be used more sparingly. See fig. 30.

LATE-FLOWERING PERENNIAL RED CLOVER (*Trifolium pratense perenne* var.), commonly known as "SINGLE-CUT COW-GRASS."—This variety flowers about three weeks later than ordinary Red Clover, and is much esteemed by all who are aware of its valuable properties. It yields one heavy cutting three weeks later than Common Red Clover, and is thus valuable as a successional crop. It succeeds well on poor and light soils, and is the most permanent and drought-resisting variety of Red Clover at present in commerce. This is the variety of red clover which has been grown with unfailing success for many years past by Mr. R. H. Elliot, at Clifton. See fig. 29.

MARL CLOVER or COW-GRASS (*Trifolium medium*).—This is the true Cow-grass, but no seed of this species is sold by seedsmen. It is not cultivated, nor is the seed of it harvested, and, except in botanical collections, it is only found in a wild state. It differs from all varieties of Red Clover in having *zigzag stems*, and having the flower-heads supported by a foot-stalk about two inches long, so that the *flower-heads are always separate from the uppermost set of leaves* on the stem. The cultivated varieties of Red Clover have *straight stems*, and the flower-heads are usually *quite close to the uppermost set of leaves* on the stem.

The weeds found in the varieties of Red Clover are chiefly these: *Geranium dissectum* (Cut-leaved Geranium), *Rumex obtusifolius* (Dock), *Plantago lanceolata* (Rib-grass), *Centaurea nigra* (Knap-weed), *Lychnis vespertina* (White Campion), *Lychnis diurna* (Red Campion), *Lapsana communis* (Nipplewort), and *Cuscuta Trifolii* (Dodder), all of which will be detected by close scrutiny, although the Dodder may be mistaken for small particles of soil. The seeds of European Clover Dodder (*Cuscuta Trifolii*) are much smaller than those of Red Clover, and may be removed by careful sifting. The Dodder, being a destructive parasite on clover, should be strictly avoided. The American Dodder (*Cuscuta racemosa*) is found in large quantities in the Red Clover seed now so freely imported from Chili and Bolivia; but the seeds of this species of Dodder are nearly as large as the Clover Seeds, and cannot be perfectly separated from them. Chilian Red Clover seed is not recommended for sowing in England, as there the American Dodder grows freely, to the great danger of the Clover crop; but in Scotland the American Dodder does not seem to thrive, and, as far as present experience goes, there is apparently not so much risk in sowing Chilian Red Clover (if free from docks) north of the Tweed. The Chilian is a very fine strain of red clover, in no way inferior to the English (which is usually acknowledged to be the best of all red clovers) in respect of hardiness, bulk of crop, or other good qualities; unfortunately, however, Chilian red clover seed invariably contains dodder seeds, which are of such a size that they cannot be entirely removed from the clover seed by any known process of separation, and it is, therefore, a matter of importance to know before sowing Chilian seed whether the dodder is innocuous in the land where the seed is proposed to be sown. See figs. 53, 54, 57, 52, 62, 65, 74, 67 and 66.

WHITE or DUTCH CLOVER (*Trifolium repens*).—No clover is more highly esteemed in a pasture than white clover, and its abundant presence is generally accepted as an indication of the goodness of the land, and high value of the pasture. On the other hand, however, if it is too plentiful it encroaches upon and prevents the growth of other plants which may be even more advantageous than the clover, so that it is not desirable to have an excess of it. It stands continuous grazing better than any other clover, and its produce, though not abundant, is of high nutritive value; it is hardy, deep-rooting, and drought-resisting, but does not grow much in very dry weather. White clover thrives in good moist soils containing some lime, but also grows on soils of inferior quality; it should have a place in pastures on all soils, but is of little value in a hay crop. See fig. 34.

The seeds of *Rumex acetosella* (Sheep's Sorrel) are nearly always present in White Clover, in choosing the seed of which preference should be given to samples which are free from that weed. The seeds of Sorrel, which are glossy, triangular in shape, and of a light brown colour, may be easily recognised. *Trifolium minus* (Suckling Clover) is sometimes used to adulterate White Clover, and as the seeds of both species are similar in colour the adulteration is not readily noticed. The seeds of *T. minus*, however, are glossy, and rather cylindrical in shape, while those of White Clover are heart-shaped. *Anthemis arvensis* (Chamomile), *Rumex obtusifolius* (Dock), *Plantago lanceolata* (Rib-grass), as well as other weed seeds, are also found in imperfectly cleaned samples, but careful examination will lead to the detection of all impurities. *Cuscuta Trifolii* (Dodder) is also to be met with, and must be scrupulously rejected. English-grown samples of White Clover frequently contain a large percentage of seeds of *Geranium molle* (Dove's-foot Geranium), and these should also be carefully avoided. The Sulphur-smoking of bad samples of White Clover, to give the appearance of sound healthy seeds of good quality, was extensively practised in this country until the passing of the Adulteration of Seeds

Amendment Act, which finally closed the establishments where this business was carried on. It appears, however, that this description of seed is still imported from the Continent and sold here as good seed. The test of germination will prove the value of White Clover, as no sulphur-smoked seed can vegetate well. See figs. 72, 59, 76, 54, 57, 67 and 55.

ALSIKE or SWEDISH CLOVER (*Trifolium hybridum*).—This Clover was introduced into Britain in 1834, from Alsike in Sweden, whence it derives its name. Since its introduction, it has established its claim to rank among the most valuable of our clovers, and its cultivation in this country is now universal. It grows as tall as Red Clover, and produces abundant crops. In nutritive value it is almost equal to Red Clover, which indeed it excels in regard to its more permanent character on many soils where Red Clover will not grow. It is valuable either for hay or pasture, and should be included in all mixtures for permanent pasture or alternate husbandry. It thrives on moist and stiff soils, but also succeeds on those that are light and poor. It is very hardy and is the only clover suitable for irrigation. See fig. 31.

Formerly, when the seed of this species was very expensive, bad samples of White Clover were dyed green and mixed with the genuine Alsike Clover; but the passing of the Adulteration of Seeds Amendment Act of 1878, seems to have put an end to this practice, and of course the temptation is not now so strong, the market value of White and Alsike Clover seeds being usually nearly equal. The test of germination will readily prove the genuineness of the seed, as inferior dyed seeds vegetate badly. The weeds commonly found in Alsike Clover are *Rumex acetosella* (Sheep's Sorrel), *Geranium molle* (Dove's-foot Geranium), *Anthemis arvensis* (Chamomile), *Prunella vulgaris* (Self-heal), *Rumex obtusifolius* (Dock), *Plantago lanceolata* (Rib-grass), *Lapsana communis* (Nipplewort), &c., all of which may be readily detected. Seeds of the dangerous parasite *Cuscuta Trifolii* (Clover Dodder) are not infrequently present in samples of Alsike Clover of Continental growth, and a very careful examination with a magnifying lens is necessary for their detection. English-grown samples, on the other hand, very often contain seeds of *Geranium molle* (Dove's-foot Geranium), a very objectionable weed, sometimes to such a large extent as to render the seed comparatively valueless. No clover seed containing a particle of Dodder should on any account be used. The purest Alsike Clover seed is now usually obtained from Canada. See figs. 72, 55, 76, 69, 54, 57, 74, 67 and 55.

RIB-GRASS or PLANTAIN (*Plantago lanceolata*).—Although found in the best natural pastures, the Rib-grass is only a weed that should never be sown for permanent pasture, except perhaps on poor, light, or sandy soils, or in elevated situations, which would not warrant the cost of higher priced seeds. See fig. 57.

SUCKLING CLOVER (*Trifolium minus*).—Sometimes recommended for permanent pastures on light soils, but, being an annual, its value for this purpose is doubtful, and its produce is too insignificant to entitle it to a place in alternate husbandry. Also known as Red Suckling Clover. See fig. 59.

BIRD'S FOOT TREFOIL (*Lotus corniculatus*).—This is found in light, dry, sandy soils, and in dry upland pastures. Its roots penetrate deeply, and it has the power of resisting excessive drought. On dry uplands or on soils too dry for clovers, a moderate quantity may be introduced, but its merits do not entitle it to a place in good soils.

TREFOIL, or YELLOW CLOVER (*Medicago lupulina*).—The Trefoil is sometimes recommended for permanent pastures, and as it vegetates readily and grows freely, it quickly makes an excellent show ; but, being only an annual, it soon dies, leaving bare spaces all over the pasture, to be occupied, in all probability, by objectionable grasses or weeds. Trefoil is useful in mixture with other grasses and clovers for one year's lay on light soils. In some districts it is also sown alone for sheep feed, and as it reaches maturity very quickly, if sown in spring the crop is ready for use the same year. It resists cold and withstands drought well, and it succeeds in calcareous soils unsuitable for red clover. It grows early in spring and comes into flower about a fortnight earlier than red clover. This plant is sometimes wrongly called "Hop Trefoil," a name which really belongs to *Trifolium procumbens*. *See figs. 35 and 70.

Being the cheapest of all clover seeds, Trefoil seed is not wilfully adulterated. The impurities usually found in it are *Sedum* (Stone-crop), *Plantago lanceolata* (Ribgrass), and *Geranium dissectum* (Cut-leaved Geranium), all of which may be readily noticed.

KIDNEY VETCH, or YELLOW SAND CLOVER (*Anthyllis vulneraria*).—Thrives on poor light, sandy, chalky or limestone soils, and has the power of resisting extreme cold in winter, and excessive drought in summer ; it does not thrive on cold, wet soils. Although a perennial plant its permanence cannot be depended upon if mown for hay the first year after sowing. The plants do not entirely disappear, but only a proportion of them survives after mowing. This, however, should not disqualify it from being used in all mixtures for lays or temporary pastures on suitable soils, as the manurial value of the residue left in the soil by the decaying roots is considerable, and as a fodder plant it well repays its cost in the first year's crop. When the plant is grazed it is much more permanent, and it may be found growing in abundance in old pastures on suitable soils. On poor, dry soils where red clover is not to be depended upon, the Kidney Vetch is an excellent substitute. It is deep-rooting and drought-resisting, and the nodules on its roots obtain and store a large amount of nitrogen from the atmosphere, which is of great value to the succeeding cereal crop. Recommended either for rotation crops or for permanent pasture on all suitable soils. See fig. 33.

YARROW or MILFOIL (*Achillea Millefolium*).—The Yarrow is found in the best natural pastures. Besides thriving in the poorest and driest soils, as well as in those that are heavy and wet, it possesses the property of withstanding excessive drought. Sheep are very fond of it, and a moderate quantity should be included in all permanent pastures. It is not desirable to sow much Yarrow when laying down land to permanent pasture as this plant has a great capacity for spreading, and even of ousting from the pasture other plants less able to hold their own. For permanent pasture, $\frac{1}{4}$ lb. per acre is quite enough, but for laying down land on the Clifton Park system for a period of from four to six years, $\frac{1}{2}$ lb. to 1 lb. per acre may be used with great advantage.

Yarrow is seldom adulterated, but the seeds of Ox-eye Daisy (*Chrysanthemum leucanthemum*) are occasionally used for this purpose. The adulteration is not readily noticed as the seeds of the two species are very small and somewhat resemble each other, but the use of a lens will enable the observer to discover the fraud. See figs. 27 and 61. Yarrow seed is often very imperfectly cleaned, and frequently not more than fifty per cent. is good seed, the remainder being imperfectly developed seeds, chaff, and refuse. Attention should be paid to the purity and quality of the seed bought, as imperfectly cleaned samples really cost double the price charged. Yarrow seed may be so cleaned that practically no refuse remains in the sample, and, as such samples have the imperfectly developed seeds removed, the percentage of germination is thereby increased.

A SIMPLER WAY IN AGRICULTURE;

OR, HOW TO FARM WITHOUT MANURES,*

By "HOME COUNTIES."

To raise a thick turf on a naked soil would be worth volumes of systematic knowledge.—*White of Selborne.*

Whoever could make two blades of grass to grow upon a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together.—*Swift.*

ALL flesh is grass.

In an acceptance of the literal truth of these words lies salvation for our agriculture.

Such is the gist of a gospel I heard preached, with impressive earnestness, conviction and authority, and a sense of humour, half-way up the Cheviots, on a gusty afternoon last September.

The preacher was certainly such as to commend his message. A landowner, white-haired, hale, distinguished, standing on his hereditary land—to which his confidence in his system of farming has lately permitted him to add another thousand acres or so; a landowner who has farmed his Roxburghshire fields for thirty years and has managed and worked his own land in India for half a century; a landowner who has chosen for his demonstration fields not small, well done, sheltered plots of lowland, but wide stretches of hill side, so rough that one's feet as one traverses it, continually scuff against stones; an experimenter who has nothing whatever to sell but a book—which, as often as not, he gives away; a contented, rich man who seeks nothing from the world but the favour of the attention of agriculturists and the public; to some pioneer work he has done for their benefit at his own charges—here was one who delivered himself on rural problems neither as the Pushfuls nor the Scribes.

All flesh is grass. "Undoubtedly," says Mr. Robert H. Elliot, of Clifton Park, Kelso—his name is identified with what is known as the "Clifton Park System" of farming—"the solution of all our agricultural difficulties resolves itself into the cheap production of a good turf. The production of stock at the lowest possible cost is what the farmer has to rely upon nowadays, and this, of course, involves the production of the food of the stock at the lowest possible cost.

"The success of our agriculture depends, in the first place, not, as the average farmer says, on raising prices, but on the cheapening of production.

"Second, the cheapest food for stock is grass.

"Third, the cheapest manure for soil is a turf composed largely of deep-rooting plants.

"Finally, the cheapest, deepest and best tillers, drainers and warmers of the soil are the roots of plants."

SOME PANACEAS AND A CRITICISM.

Mr. Elliot has small patience with some esteemed remedies for agricultural difficulties.

Bimetallism: "Who knows," he asks, "what would occur?"

Protection: He thinks that "there seems to be a small prospect of Protection ever being adopted in England within any time worth considering; as to Protection on the Continent, in France Protection gives the agriculturist 8s. 2d. more per quarter, and yet the farmers of La Manche, in Normandy, have given up the growth of cereals for sale, in favour of permanent pasture, and now only produce enough grain for consumption on the farm."

Land legislation: "Turn back to the most prosperous times, when farmers laid out most capital on the land, and see how little the laws can affect the farmer. In those good days we had the laws of hypothec, and we had neither the Agricultural Holdings Act nor the Hares and Rabbit Act; those, also, were the days of high rents."

In short, Mr. Elliot is for no "dangling of false hopes" before the eye of the farmer—"all our attention should be concentrated on the practical remedies within our reach that can be immediately applied."

THE REIGN OF "CHEMICALS."

As to the message of the agricultural colleges and the text-books to the farmer it would appear, he says, that "our agriculture is not on a home-supporting basis. Its real basis is apparently artificial manure, a large proportion of which is imported. Where copious supplies of town-derived manures at cheap rates are not available, says a recent writer, the farmer 'finds it essential to make liberal use of artificial manures if he is to grow good and profitable crops.' If we turn to the reports of agricultural associations, and the work of agricultural schools and colleges, we shall find that nearly all the experiments made by them encourage a more extended use of commercial fertilisers.

"And what has resulted from our expensive system of agriculture, with its costly artificial manures? Has it prevented millions of acres being thrown out of cultivation into worthless pastures, our rural labourers being reduced in numbers, and our soils becoming more and more deteriorated, and consequently requiring a greater and greater expenditure in artificial manures? Has our system arrested the serious decline of humus, or in other words, that

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decaying vegetable matter which is so essential to the fertility of the soil? That our system has not done so is only too true; and if it has not saved us in the past from the evils I enumerate, why should it do so in the future? So far from the more extended use of artificials improving our agriculture, it will only tend, as they are at present used, or rather misused, to deplete still further our largely exhausted soils. Our schools and colleges ought to teach the farmer that it is far cheaper to grow manure than to buy it, and that purchased fertilisers should only be used in small quantities and as an aid to all the fertilising agents that the farmer can profitably produce himself."

THE BILL FOR PHYSIC FOR THE LAND.

Across the Atlantic a protest is beginning to be made by agricultural writers against the undue use of artificials. The bill of the farmers of the United States under this head is stated by one authority, I see, to total up, for five years only, to something like a quarter of a billion dollars! The American writers referred to, urge the farmer, as Mr. Elliot says, "to cut the fertiliser bill in two, and aerate, till, and manure the soil as far as possible by a sound system of agriculture." One year, Mr. Elliot, by the aid of his system of growing manure, produced good and profitable crops of all kinds without spending one shilling on artificial manures. He only uses them to a limited extent—4 cwt. to 5 cwt. an acre in the case of the turnip crop—and even this is not necessary in a fine season, as he claims to have proved. "My use of them occurs," he explains, "because our seasons are so precarious that not to use artificials to help turnips along quickly when they are young would involve a certain amount of risk from 'fly'."

There is nothing new in all this. Two centuries before Christ did not an agricultural writer declare "a good husbandman should be a seller rather than a buyer"? "If I am asked," this ancient authority goes on, "what is the first point in good husbandry, I answer good ploughing; the second, ploughing of any kind; and the third manuring." And, of course, as a modern expert has said, "in a very important sense tillage is manure." Mr. Elliot contends, in his turn, that "tillage by the agency of roots is the best and by far the cheapest form of tillage; that it is the best anyone can see for himself by digging up the soil in forest-clad land; that it is the cheapest as well as the best in arable land is evidenced by the great depth to which chicory and burnet roots penetrate."

EXEUNT CEREALS: ENTER GRASS.

"To resume, then, to myself and to others who had equal opportunities of making sound forecasts, it was evident that a system of cultivation depending largely on cereals would have to give way to one mainly depending on the cultivation of grass and forage plants, and also on cheapening the cost of production all along the line, for it was evident that if other countries could produce so much more cheaply than we could we must produce more cheaply than we do now, or go to the wall. I by no means take those gloomy views of our prospects which are entertained by a large number of my countrymen. Judging by the financial result of my own farming in recent years I see no reason to despond, if we turn our attention to altering our system in the direction of limiting cereals to the utmost, producing them at the lowest possible cost, and introducing improved grasses and other kinds of forage plants. For we have an admirable forage growing climate.

"It should be considered that the system I have to advocate, depending entirely upon stock, etc., will be much safer than our old arable culture. For with that we had the maximum of risk, combined with the maximum cost and destruction to the fertility of the soil. The first great meeting of four hundred Aberdeenshire farmers, held a quarter of a century ago, declared that one of the three great causes of their difficulties was the exhaustion of the soil. The system I urge will continually enrich the soil, and, what is often of greater importance, improve its physical condition. As Sir John Lawes well pointed out, it is the physical condition of the soil, its permeability to roots, its power of absorbing and radiating heat, and its power of absorbing and retaining moisture, that is of more importance than its, strictly speaking, chemical composition. Every agriculturist should lay this truth to heart. By growing a mixture of large-rooting and deep-rooting plants, managing them well after they have grown, and giving them four to six years' time to form into a turf, the farmer, when he again ploughs up the land, starts his rotation with the same advantages which the farmers had when they enclosed and ploughed up old pasture lands: he will thus be enabled to do two things. First, he will produce good crops at the smallest expense. The farmer using the four or five course rotation has to go to the expense of sowing grass seeds twice, while with my eight years' rotation—I will give the details later on—there is only one sowing of grass seeds. In the second place, the farmer will produce his good crops without the aid of manure, excepting some artificials with his turnips, and eventually without any, when the land has become sufficiently charged with humus. Potatoes as well as turnips have now been successfully grown at my Clifton-on-Bowmont farm without the aid of manure except that supplied by the turf.

CHEAPENING CULTIVATION AND DOING AWAY WITH WEEDS.

"At first the process must only be continued for four years. After the turnip crop, taken after ploughing up the grass, the cereal crop will be grown. Then a root crop will follow. The next year the land will be again laid down to grass with a light cereal crop, and the process of forming a good turf re-commenced. Every time this course is repeated the land obviously becomes richer and warmer, and the soil more thoroughly and deeply disintegrated by the roots of plants, and therefore more able to yield better and more certain crops, and crops less liable to disease.

"The formation of this turf will also cheapen the processes of cultivation in two ways. First, land deeply and thoroughly permeated with vegetable matter is much more easily ploughed and worked. In the second place, if the land is well filled, when laid down, with a mixture of plants which have a large and powerful root system, the couch or twitch grasses are extinguished, or nearly so, and the expense of cleaning the land, when again brought under the plough, absolutely abolished. For the last fourteen years there have been at Clifton-on-Bowmont, as you can see for yourself [I did see it.—"H. C."], no weeds worth removing. Taking a turnip crop after grass is essential, but when the farm has once been so thoroughly cleaned that there are no weeds on it worth removing, the farmer, if his plans make it expedient, may begin his rotation with oats out of ley instead of turnips. On the rapid creation of a turf composed of plants calculated to leave the largest amount of vegetable matter in the soil, and of plants well able to resist drought, and contribute by their qualities to keep stock in good health, the future of our farming, so far as the arable portion of our lands is concerned, depends; and it is hardly necessary to say that the same principle applies to the creation of permanent pastures.

"Chicory, which constitutes four pounds out of every forty-seven pounds of grass seed I sow per acre, leaves passages in the soil down which the roots of other plants will descend to feed at greater depths in the soil than they otherwise would."

"MAKING A PASTURE BREAKING A MAN" NO LONGER TRUE.

The reader, with any knowledge of agricultural processes at all, has no doubt found this all simple enough. Why then, he may ask, have not farmers either found it all out for themselves or, now that Mr. Elliot has made the way plain in four successive editions of a book which can be bought for 3s. 6d. ("The Clifton Park System of Farming and Laying Down Land to Grass," Simpkin, Marshall) followed his teaching? One reason probably is that although they believe in that part of the old saying which speaks of breaking up an old pasture making a man, they are unduly fearful of the second part of it about the making of a pasture breaking a man. "It is a saw," says Mr. Elliot, in his downright way, "once most true in consequence of bad and improper seeds, and bad methods of laying down, and not so very long ago; but now most ridiculously false.

"Up till 1883, when James Hunter introduced the system of guaranteeing the purity, genuineness and percentage of germination of farm seeds, no firm of seed merchants offered seeds except under non-warranty clauses, which may still be found printed on the letter and invoice headings of some well-known firms. Now, however, the farmer who wants certain seeds, &c., can get exactly what he orders, and can buy subject to the analysis he has made on the arrival, not of the sample but of the bulk. The recommendation of Mr. Hanbury's Committee in 1900, that farmers should be advised to buy only from firms which guarantee their seeds, has borne fruit. But thousands of farmers continue to buy rubbish, and then wonder that their laying down to grass does not turn out well. Even such a master of the subject of grass production as Lord Leicester, is under the impression that 'no merchant can deliver natural grass seeds absolutely free from the seeds of couch grass.'"

WHEN BRAINS MUST BE USED IN FARMING.

The second reason why farmers have not followed the simpler way in agriculture is partly because of the way in which the virtues of "chemicals" have been preached at them, and the extent to which these artificials have been bought by their betters, and partly because farmers as a class are not given to much original thinking.

Mr. Elliot himself asserts that while making some investigations on one occasion at the office of the Royal Agricultural Society, he was "told by a clerk that never in his experience had a farmer come to them to ask a question, or go into an inquiry of any kind." The author of the "Clifton Park System" is in no doubt as to the reason. "Farmers here, like planters in India, will not read. Both have probably taken to cultivation from a liking for out-door life and an indisposition to intellectual exertion. The sharp lads in families are generally sent into law, medicine or trade, while the duller are considered to be only good enough for agriculture, where study, though quite as essential as in other professions, may be neglected without much loss until changing times require important modifications of system. And yet farmers are ready enough to adopt improvements in the shape of improved stock and agricultural implements and machines. The explanation of their resistance to agricultural change is that they cannot afford to attempt improvements which are to them of a speculative character, and are afraid of being persuaded to adopt measures which may turn out to be failures. An improved animal they can see, and from it gain an immediate and certain result, and the same is the case with an improved or new implement. But the return from any new course, such as altering their rotation or laying down land to grass, either permanently or for five or six years, requires a considerable time in order to prove the utility of so doing."

Mr. Elliot is not the only agricultural authority who has urged the accumulation of fertility in poor lands by laying them down to grass. Lord Leicester's name has been already mentioned. But Lord Leicester says the minimum time the land should remain in pasture is six years. Mr. Elliot's comment is: "With the mixture he uses, I have no doubt that time would be required in order to accumulate a sufficiently good turf. But if a mixture is used containing a quantity of cocksfoot and yarrow, and other plants calculated to fill the land with vegetable matter, then I think that a good turf, and one much better than would be obtained in six years from the mixture Lord Leicester uses, could be produced in four years." Mr. Elliot uses forty-seven pounds of seed per acre against Lord Leicester's seventeen pounds.

A STATE OF THINGS THAT CANNOT LAST.

"He would be the best Commonwealth's man," says Gilbert White, "that could occasion the growth of two blades of grass where one alone was seen before." Farming, in Mr. de Laune's words, has come to be, however, "more often the act of destroying natural fertility than adding to it, and it is no wonder therefore that the land becomes impoverished." "For the last thirty years," says Mr. Elliot, "I have had British arable soils through my hands on a large scale, from alluvial flats up to poor soils 800 ft. above the level of the sea, and find an only too ample confirmation of the general complaint of practical farmers. With the aid of liming, and a freer and freer use of artificial manures, the decadence caused by the exhaustion of organic or vegetable matter is steadily continuing. And the farmer expects that foreign competition may be met by ever augmenting bills for purchased fertilisers, which will cause the soil still further to decline in fertility, while the agricultural chemist, aided by the manure merchant, is emptying his pockets. and, at the same time, enabling the farmer to run out the remaining fertility of the soil." Up to about the time when Queen Victoria came to the throne there were no "artificial" to be bought; roughly speaking, the land nearest the homestead got dung, and beyond the reach of the dung-cart was left in grass. There succeeded a period of cheap "artificial," a few sackfuls of which could be easily transported to the outlying fields so that all could be brought under cultivation, with the result, as has been seen, that humus has been depleted and nothing has been put back but chemicals. Obviously, such a state of things cannot go on.

DEPLETING THE LANDLORD'S CAPITAL.

Mr. Elliot's appeal to the countryside to recover fertility by intelligent putting down to grass is an appeal not only to the farmer but to the landlord, whose capital, the fertility of the soil, is, under present conditions, being taken away from him. "The interests of landlord and tenant," says Mr. Elliot, "have been in a great measure opposed, the object of the tenant being to take all he could out of the land, and the object of the landlord (which he endeavoured to compass by covenants at letting) to retain all the strength he could in it; and, with the aid of artificial manures, the tenants have been only too successful in depleting the soil, and, in a large number of instances, after having sucked the orange, have thrown the empty peel in the landlord's face. With the system I advocate it will be as much to the tenant's as to the landlord's interest that all the strength possible should be retained in the land, for on no other principle can farming in these islands be profitably carried on in the future."

"Italian vine growers give the soil humus by heaping gorse and heather between the rows of vines; French agriculturists, in order to improve certain arable lands, sow a mixture of gorse and grass, to be cut for hay, with a view to improving the depth and texture of the soil, which, after a certain number of years is again brought under the plough. But I have found from using chicory, burnet, kidney vetch, and a liberal supply of yarrow, that there are other attendant advantages besides that of disintegrating the soil and supplying it with vegetable matter, for all light land is, of course, very liable to suffer from drought, and all these plants resist drought to a wonderful degree. In 1895 there was a very severe drought, and I carefully examined the plants growing on the gravel beds of a large flat field by the side of a stream. Grasses and clovers were withered to the ground. The clover leaves crumbled in the hand as if they had been scorched, but the drought-resisting plants I have named were green and sappy. Burnet was as green and fresh-looking as a thriving strawberry leaf. Burnet and yarrow are also useful for their medicinal qualities in the case of sheep. Chicory is a plant the roots of which go straight down, and the leaves of which go straight up."

For the technical details of the work of Mr. Elliot the reader must go to the remarkable collection of memoranda—there are about 2,000 references in the index—contained in his book. No one who reads it or walks over the farm, can be in doubt that the author's claims have been made out: "I have solved the problem as regards cultivating poor lands without the aid of any manure, and have solved it to the extent of growing on the poorest land, crops as good and indeed much better than those commonly grown on the best land; and I have done this, too, after leaving the land only four years in grass, and on a system which is continually improving the fertility of the soil, and increasing the depth available for the roots of plants."

In his East Countryside field—fifteen acres—Mr. Elliot has produced, *without any manure whatever*, by way of experiment, a crop of turnips which "competent practical judges declared could not be surpassed."

NO MANURE FOR SEVENTY YEARS.

A field of twenty-five acres, the Inner Kaimrig, of the class that in the past should never have been enclosed from the hill or ploughed up, unless for putting down to pasture on modern lines—everything had come down from it and nothing but ploughs, horses and farm labourers had gone up—was put down in 1890 to oats and seeds, but the particularly deep-rooting plants like burnet, chicory and parsnip were not included. After three years' trial in grass, with grazing by sheep, it was ploughed up for sowing with a larger proportion of deep-rooting plants, such as had been used in the Outer Kaimrig field. In 1894 a fair crop of turnips was taken, and in 1895 the seeds, with a thin seeding of oats, were put down. In 1896 not less than two tons an acre of hay was got from the field, and there was a fine aftermath. The next year the field was grazed by sheep and lambs, and in 1898 it, in Mr. Elliot's words, "exceeded my utmost expectations, showing that the manurial effects of the ploughed-up turf was still going on."

This was a field that had had no manure, other than from grazing animals, for seventy years, and pronounced, when Mr. Elliot took it in hand, to be not worth 5s. an acre. "Its

twenty-five acres have now kept as much sheep stock," says Mr. Elliot, "as the eighty-seven acres of the fields of an adjoining farm where the soil and situation are better."

HEALTHY STOCK AND CROPS FROM HEALTHY SOIL.

It is not only that Clifton carries a large proportion of sheep. They are in good health, owing to the deeply aerated soil and superior grasses. The death-rate among sheep on similar farms, which is about 9 per cent., is said to be only 3 per cent. at Clifton. The same with turnips as with sheep, says Mr. Elliot exultingly: "When I have heard numerous complaints respecting turnip disease, our turnips have looked most healthy throughout. We have had finger and toe once only. Large sums are spent on heavily liming land, because it is a preventive of turnip disease. From my long experience I am strongly of opinion that all the money spent on remedies might be saved were the land well stored with turf in various stages of decay. We have not had potato disease once in twenty years. From a healthy soil we have healthy crops."

The outer Kaimrig field (twenty-three acres) is the most outlying one on the farm and extremely exposed. It ranges from 700 to 800 ft. above sea level, and has no protective hedge or plantation. For seventy years it also had no manures except a sprinkling of artificials with turnips, and what the grazing animals left—and the good turf grown with deep-rooting grasses and plants. In 1900 it carried:

April 27 to June 13, 60 half-bred ewes and twin lambs, afterwards increased to 80 ewes.

June 13 to July 27, 80 ewes and twin lambs.

July 30 to August 21, 180 lambs.

August 21 to September 1, 100 ewes.

October 5 to November 10, 60 ewes.

"And," Mr. Elliot says, "the field would have kept much more stock!" "Those who have not seen the field," he adds, "cannot believe in the number of stock it has carried. The explanation simply is that, if you grow a full supply of the most deep-rooting plants, you tap depths quite out of the reach of the shallow-rooting rye-grass, and certainly add about 30 per cent. to the available rootage area of the field; the large supply of plants of rapidly productive powers does the rest."

A FAMOUS FIELD AND ITS NEIGHBOURS.

Instructed visitors to Mr. Elliot's estate ask for the famous Bank Field. More than half of it is poor, stony and exposed, and in some parts steep. The remainder is what its owner calls "fair medium soil for this part of the country." For nineteen years previous to 1900 twenty-four acres had no manure except from the grazing animals and the artificials used with turnips. The remaining part once received some of the small quantity of farmyard manure available on a breeding farm where very little indeed is made. The history of it up to 1901 is as follows:

1890 Grass (sown 1888).

1894-6 Grass.

1899 Turnips.

1891 Oats.

1897 Turnips.

1900 Barley and seeds.

1892 Turnips.

1898 Oats and Barley.

1901 Hay.

1893 Barley and seeds.

The 1900 mixture was this:

Cocksfoot, 14 lb.

Late-flowering Red Clover, 2 lb.

Burnet, 8 lb.

Tall Fescue, 7 lb.

White Clover, 2 lb.

Kidney Vetch, 3 lb.

Tall Oat-like Grass, 7 lb.

Alsike Clover, 1 lb.

Chicory, 3 lb.

Rough-stalked Meadow Grass, 1 lb.

Yarrow, 1 lb.

Total, 49 lb. to the acre.

(Later observation would lead Mr. Elliot to add a half-pound of golden oat grass per acre.)

From October 1, 1900, to October 15, 1901, the value of the grazing and hay was estimated by an independent valuer at £7. 7s. 6d. an acre, and while, owing to the drought there was a general failure of grass in the district, the Bank Field presented a most luxuriant appearance all the season through, the colour of the clover and kidney vetch being such that visiting farmers thought the field had been dressed with nitrates! "And so it had been," says Mr. Elliot—"from the atmosphere!" "The fact is," he goes on, "that with our system no manure is required over and above that supplied by a deeply rooted turf, the nitrogen collected from the atmosphere by our abundant clover and kidney vetch, and the artificials used with the turnip crops. As to drought our system clearly proves that a means lies to the hand of the farmer by which he may regard the worst drought with indifference!"

What the grazing of the Bank Field was worth from October, 1900, to the same month in 1901 has been mentioned. In the following twelve months the list of stock carried by it was as follows:—

October 1, 1901, to December 31, 1901: 4 ewes per acre, with the assistance of a daily cartload of cabbages or turnips.

March 15 to May 22, 1902: 3 ewes and single lambs per acre, with two daily cartloads of turnips.

May 24 to July 28, 1902: 2½ ewes and single lambs per acre.

July 28 to October 1, 1902: 3 ewes per acre.

May 1, 1902, to June 10: 5 cattle.

June 13 to September 4: 2 horses.

THE VERDICT OF SCIENCE—

Mr. Elliot explained to me, when we walked through the Bank Field, why it has remained in grass since 1902. It was retained, he said, because it had grazed so well, because visitors asked to see it, and because it was the subject of Dr. Voelcker's analysis in order to

find to what degree the fertility of the soil was being diminished or added to under the Clifton Park system. The sods annually examined by Dr. Voelcker have been taken for him for seven years close to where the previous year's sample has been obtained. His summing up, in January of the present year of the results of his investigations is impressive reading. The 1902 and 1907 figures are as follow:

	1902	1907
Organic matter	8.98	9.54
Nitrogen ... ..	.263	.288
Equal to Ammonia ... ..	.319	.350

It may be suggested that carefully though the sods may be cut there are necessarily features which prevent the soil of one year being strictly comparable to that taken from an adjoining spot in a different year. Nevertheless, writes the analyst:

A general review of the figures makes it abundantly apparent that the soil is not undergoing deterioration in respect of organic matter or nitrogen, but that in 1907 it was even richer than it was in the earlier years.

Further, the analysis of the second depth of nine inches of soil, taken in 1903, shows that in the lower layers there were good supplies of organic matter and of nitrogen.

The main point to be remembered, however, is that the vegetable matter, instead of being, as shown in the case of the old Cheviot turf [Hill sods, unploughed from time immemorial, supplied to Dr. Voelcker for purposes of comparison—"H. C."] stored up in the top surface and remained there more or less in an inactive and useless state, is under the system pursued by Mr. Elliot, becoming distributed more regularly throughout the soil, and is at the same time being rendered active and available.

The same holds good, as a consequence, with respect to the nitrogen, this being largely derived from the organic matter.

The mere richness of a particular layer in organic matter and in nitrogen—as shown by the figures of an analysis—is not enough to indicate whether this be beneficial or not, for as in the case of the old Cheviot turf, these constituents may be present in the form of a spongy, infertile mass of roots accumulated at the surface. The real test [How frequently has this test not been made in analyses!—"H. C."] is whether the total amount of organic matter and nitrogen in the whole mass of soil constituting the growing area is increased, and whether this is of such a nature as to be available for use by growing plants. I cannot fail to be struck by the marked improvement which has gone on from year to year in the character of the soil. The gradual penetration of the humus to the lower layers has been very apparent, and with this has come about the deeper penetration and more free growth of the rootlets of the plants.

When I see what the soil originally was and what it is now, I can only describe the change by saying that *soil has been formed*. I cannot say, of course, that the stones have disappeared! But they have at least become less obtrusive and more surrounded with good soil, and the whole has a more healthy appearance and is more what soil should be. This change I cannot but attribute in chief measure to the system which has been pursued by Mr. Elliot.

That the matter may be perfectly clear to the reader let me repeat the Clifton Park rotation: turnips out of grass, oats, turnips, and either oats or barley with grass seeds, when the land is left for four or five years in grass, fields being taken up again a year earlier or later as may appear advisable from the condition of the grass. "If we take three rotations of eight years each, which is practically my system," says Mr. Elliot, "there will be twelve years of grass, six of turnips, and six of corn. Taking five rotations on the five-course system, there would be ten years of grass, ten of corn, and five of turnips. The great change in the system is that by altering the old system from grass crops in divisions of two years each, I am enabled at no greater average cost per annum, and even at less, to put down a first-class grass mixture which will not only yield much more and certain food, but leave behind it for the succeeding crops a rich and deeply rooted turf."

—AND PRACTICE.

Mr. Elliot's farm, Clifton-on-Bowmont—about eight and a half miles from Kelso—is always open to visitors by appointment with the steward, and there are quite a hundred every year. They have come from nearly a hundred counties and from all parts of the world. One tenant farmer who has tried a modification of Mr. Elliot's system, says that under it he is "now thoroughly convinced most of the poor land in this country could be profitably farmed."

"I have never had turnips do so well, he writes, and the system saves 30 per cent. in labour and manure. One point always strikes me when visiting Clifton, such crops from year to year when so much breeding-stock is reared and sold off the place, and so little feeding-stuff consumed—practically none. I know of no other secondary arable farm farmed on the old system and sown down every year with ordinary grass mixtures, that would continue to grow paying crops unless a very great amount of cake-fed manure, or other artificials were applied to the turnip break every year. Even valuable old pastures quickly degenerate when stock are kept without extra cake feeding. Your wonderful success on poor high land in growing potatoes also raises the question of how much might be made from that valuable crop through cheap production by natural means, and practically no other expenses than the labour of planting and lifting in contrast with the regular potato districts, with their high rents and enormous expenditure of artificial and farmyard manure."

One year Mr. Elliot, without any other manure than turf, produced 13 tons 14 cwt. of potatoes per acre; an agricultural college experimental farm, by means of 12 tons of dung and 6½ cwt. of artificials produced only 13 tons 7½ cwt.

But perhaps the most impressive practical testimony to what has been achieved on Mr. Elliot's land was the characteristically cautious reply given by a Scots tenant farmer who was visiting the fields of Clifton from England. "Weel," he said, "I've come five hundred mile to see it a', and am no vexed that I came!"

OF PLEASURE FARMERS AND SEEDSMEN.

Two arguments Mr. Elliot is fond of using in favour of his system is that it is suitable not only to tenant farmers, but to the habits of gentleman farmers, who do not feel inclined to rise early and eat the bread of carefulness, and that it shows favourable results in wet years as well as in seasons of drought. Of course he insists on the necessity of a careful weighing of local conditions and a none the less careful management of the pasture when laid down. On good, moist soils at a moderate elevation Mr. Elliot approves of a mixture of Mr. Hunter's in which meadow fescue, meadow foxtail, and timothy grasses are introduced. As to the

prejudice of many farmers against grasses which, like cocksfoot and tall fescue, may become coarse, the proprietor of Clifton says: "The intelligent farmer sows plenty of the seeds and grazes the grasses so that they may be kept in a constant succession of young leaves; the uninformed farmer puts down a small quantity of the seeds, with the result that each plant grows like a bulrush, whereas by crowding the plants each one becomes small and fine." The cost of the Clifton mixture ought to be about 50s. per acre or 10s. an acre a year, if the land is left in grass for five years. How imperative it is to have the best seeds is illustrated by an experience of Mr. Elliot's with the seeds of two seedsmen. "The cattle stopped grazing at the exact spot where the rival seedsmen met, and I had to send a boy to herd the cattle on to the acres allotted to the local seedsmen. For more than ten years afterwards there has been a marked difference between the two patches."

THE TWO GREAT ENEMIES.

I ought to mention that Mr. Elliot has views on the substitution for turnips of fog (or aftermath allowed to stand for the cattle till the winter or spring instead of being eaten up at once). The system is prevalent in parts of Wales, and, it is contended, results, when the right varieties of grass are sown, not only in the saving of turnips referred to, but in clean, level, close turf. Turnips, as even the novice is aware, are merely a means, and an expensive means, to an end, and in Mr. Elliot's eyes are, with cereals, the farmer's "two great enemies." "By the adoption of a system of rouen and foggage, combined with a liberal use of oilcake whenever the prices of it are as low as they are at present, and by only growing enough cereals for consumption on the farm, we shall produce what we can produce most cheaply, grass, and the inhabitants of other climates—warmer ones with cheaper labour—will produce for us all the grain we require. The farming of the future resolves itself into plenty of stock and abundance of grass and oilcake to feed it."

Even the expense of the subsoiler is done away with in the Clifton Park system, for chicory and burnet, as we have seen, "do the work of piping and aerating the soil and bringing up the manurial matters which have filtered downwards in past years."

A large American work on soils which Mr. Elliot and I had both been reading gives a great deal of space to the question of the damage done to land by scouring. In this connection Mr. Elliot refers to a severe thunderstorm in the Cheviots some years ago. In his district soil and turnips together were washed off the land, but in the case of three turnip fields of his, one of which received the water from a steep, hard hill above, there was no loss. "No muddy water left the field," he says. "It was all absorbed in the decaying turf and decaying roots of the deep-rooting plants which had been ploughed into the ground."

Again, every time the land at Clifton is ploughed up it shows itself darker from the increase of humus. What this signifies may be realised from the fact that, according to an authority, a dark-coloured soil is, near the surface, 8 degrees warmer than a light-coloured one.

HOW THE FARMER MAY MAKE THE BEST OF IT.

A tenant of Mr. Elliot's is able to keep a third more stock since he adopted his landlord's ideas as to the kinds of grasses to grow. "But the object of my work," says Mr. Elliot, "is not to exhibit my skill as a stock farmer, or the want of it, as the case may be, but my skill in most economically producing cereals, potatoes, and food for stock. In little more than two years we can now raise a turf which, at a little distance, looks like an old pasture, and on a close inspection might be taken for five-years-old grass, while in five years we have a grown pasture that no one could distinguish from old grass."

That Mr. Elliot is no longer speaking to wholly inattentive ears may be realised from the fact that his recommendation of certain mixtures of grass seeds seems to have raised the price of some of them! As its proprietor says, there is no show farming at Clifton. The object is to demonstrate what can be done with the available resources of Nature. After that is accomplished it is time enough to incur expense. The average farmer complains, not without some reason, that the recommendations of agricultural text-books and agricultural lectures may be all very well, but they mean increased expense. Mr. Elliot points the way by which expenditure may be decreased. Instead of buying their nitrogen they are to produce it themselves. In his own case he has no reason to complain of the results of his anti-physis system. From year to year his capital, the fertility of his soil, has been increased, not diminished. Where he found 6 in. of soil he has now 9 in. of finely worked stuff. When fields in the district are brown, Clifton is as a green oasis. He has made steep hill-side, as one farmer visitor said, into "£2-a-year land." He confidently recommends his ideas to the farmers and owners of all soils but heavy clays. It is not often that a rural panacea is offered of equal value to both landlords and tenants. Some landlords are receiving heavy rents, but if the men who pay them are destroying the capital of the owner of the land by using up the fertility of the soil, how can he and his be gainers?

It was said of the Elliots of old time that they never killed a man unless it was necessary to do so in order to possess themselves of his property. The motto of the Elliot of Clifton Park is "Fortiter." When certain land, formerly rented at £1200, fell in value to £900, and then only £600 was offered for it, Mr. Elliot resolutely took over the farm himself. It was a good thing that he was brought face to face in this way with the fall in prices, or there might never have been the "Clifton Park system" of farming. The fall in prices, to which our agriculturists have to accommodate themselves, whether they like it or not, will be a blessing in disguise to others than Mr. Elliot if those who live by the land are driven by it to set their wits to work, as he did, and as business men of the towns have to do, to adapt themselves to the new conditions of their day and generation.

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